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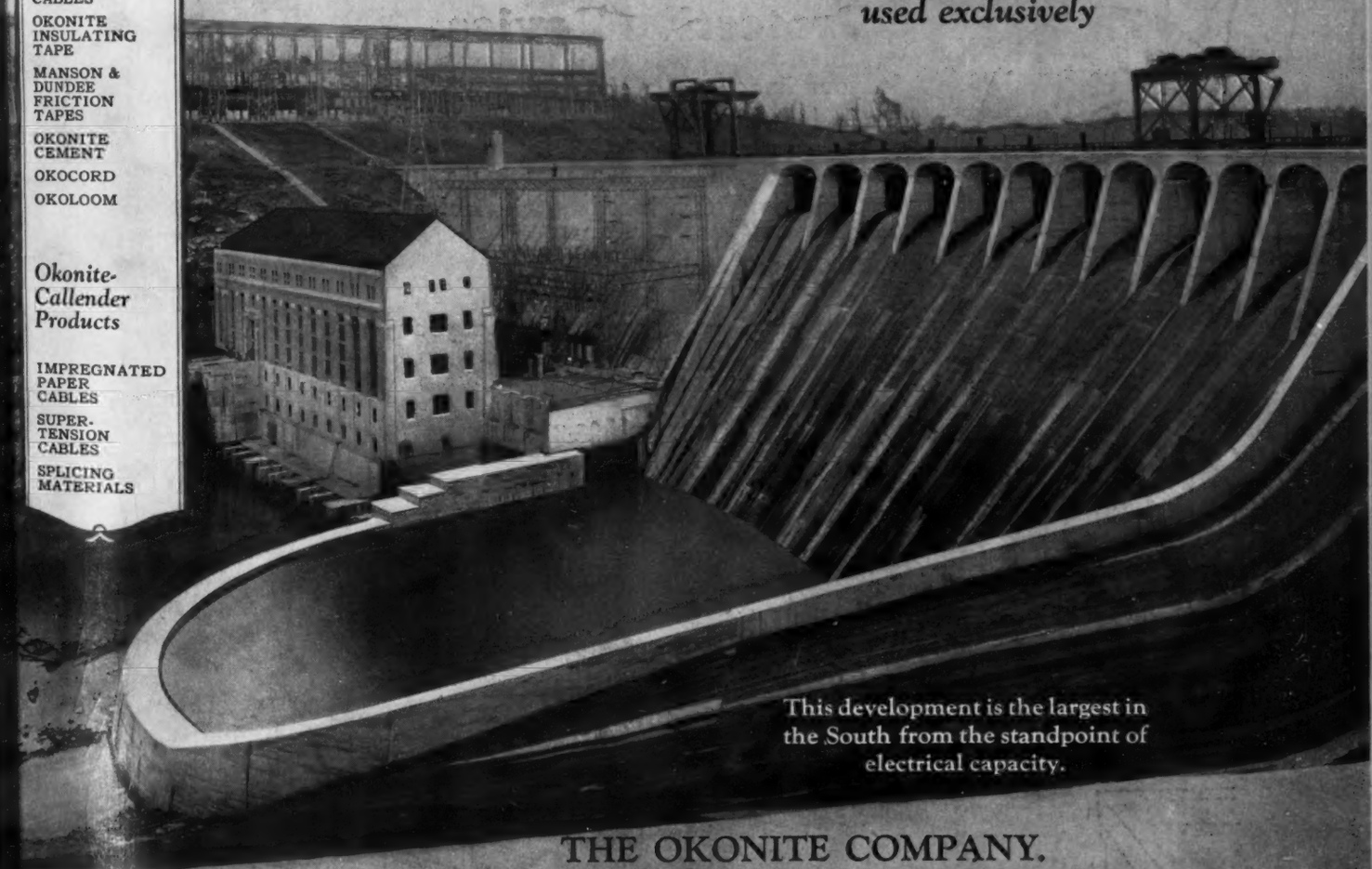

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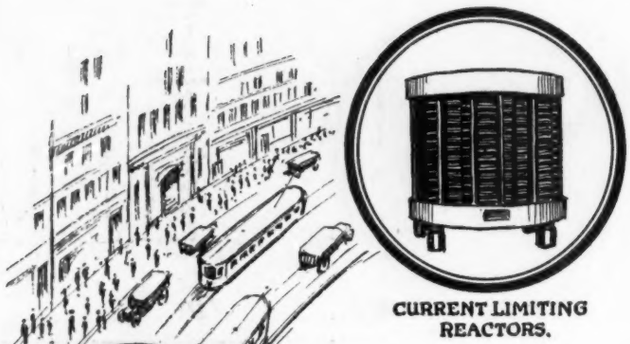

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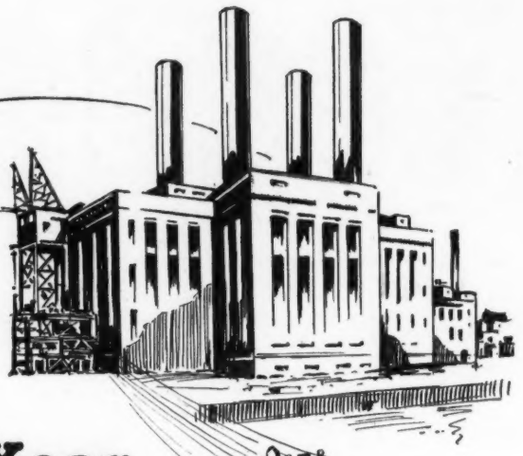

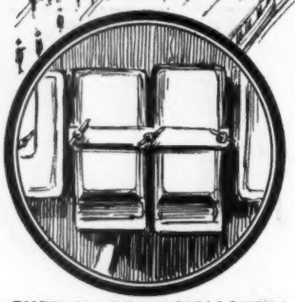

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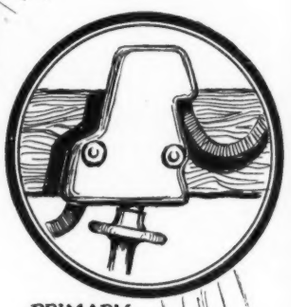

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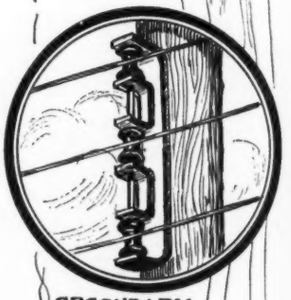

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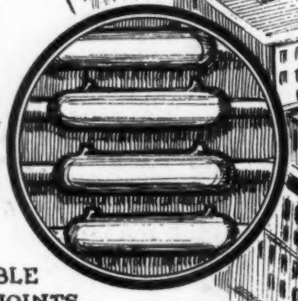

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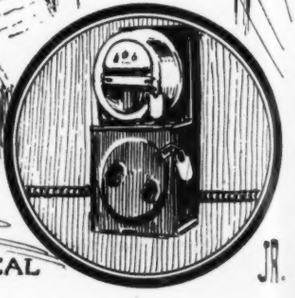

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Limited Number of Statistical Reprints Available

HOUSECLEANING time often recalls activities and interests of former days and forces decisions regarding things to be cast aside as no longer useful though in their time obtained only by considerable labor. Sometimes they might be of value to others, if we but knew it.

So our periodic check-up has revealed reprints of tables and charts of which a limited number are still available for distribution. Some titles and dates of publication are:

"The Industrial Load of the United States, and of Individual States and Regions Classified by Industries," Jan. 2, 1926.

"Industrial Load in Pennsylvania," Dec. 31, 1921.

"An Industry Balance Sheet," May 8, 1926.

"Number of Central Stations Grouped According to Number of Lighting Customers," and "Number of Customers Classified According to Voltage," 1926.

"Number of Cities and Towns Served," June 12, 1926.

"Number and Generator Rating of Central Stations," March 27, 1926.

"Electrical Data for Various Nations of the World," Jan. 9, 1926.

"High Lights in the Progress of the Electric Light and Power Industry," Jan. 2, 1926.

"Number of Central-Station Customers, by States," Jan. 1, 1927.

"Statistical Summary of the Industry," Jan. 1, 1927.

"Trends in Electrical Costs" (charts), Jan. 1, 1927.

"Power Station Building in 1926," Jan. 1, 1927.

"Summary of the United States Census of Electrical Manufacturers for 1925," April 30, 1927.

"Prime Movers, Generators and Motors in Manufacturing Plants (1925)," Aug. 13, 1927.

"Chart for Determining Transmission-Line Drop," May 28, 1922

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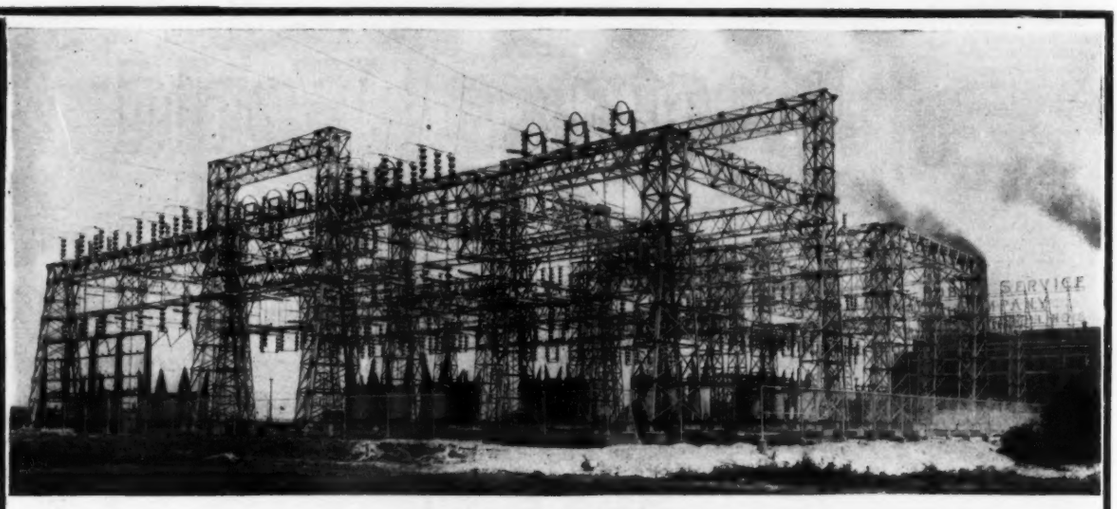

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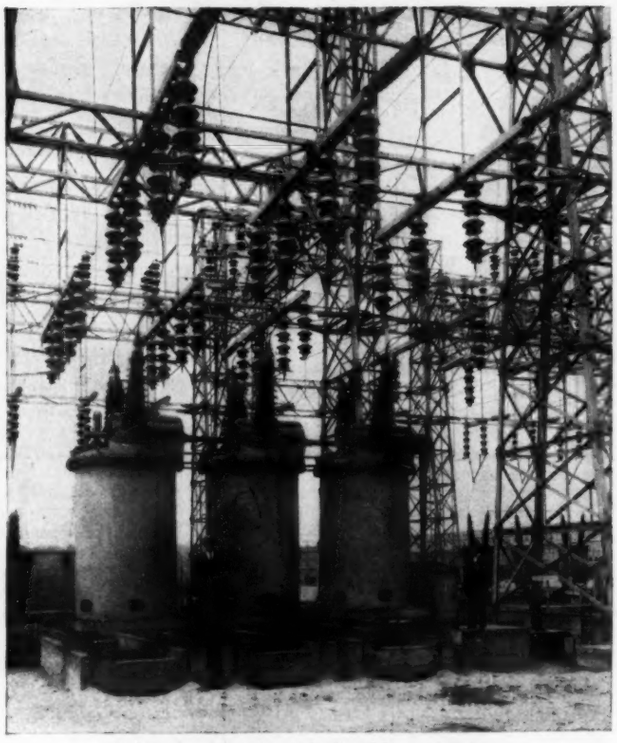

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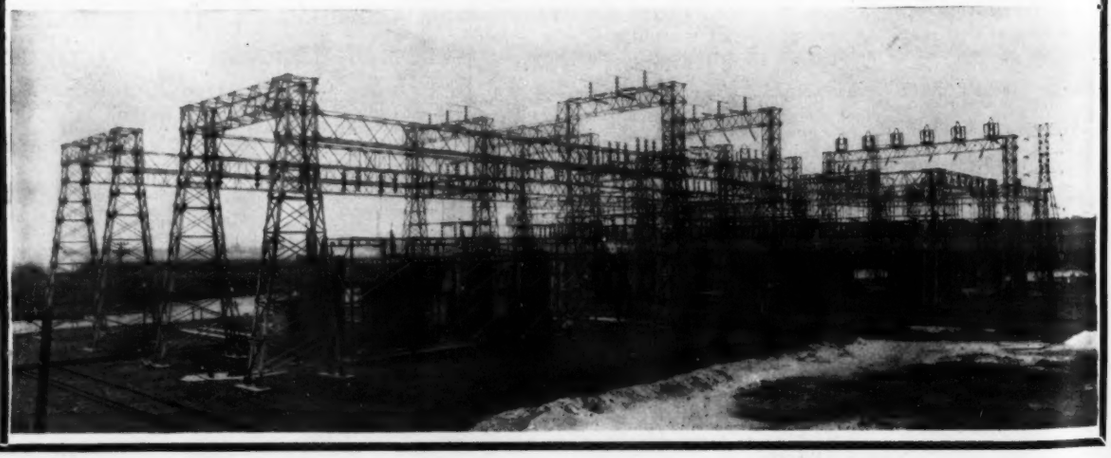

Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 90 — *New York, Saturday, October 29, 1927* — NUMBER 18

Power Companies Make Good Citizens

BY ALL the tests of modern sociology the good citizenship of electric utilities has been established beyond cavil. Through progressive management, helpful employees, large contributions through taxes to the public treasury, fair prices and good service these organizations stand in the front line of constructive business enterprises. When they take part in movements for the general welfare of communities, districts and regional areas they go still further. Such co-operation as the utilities render, for example, to the New England Conference and Council, as described by Samuel Ferguson at the recent convention of the Empire State Gas and Electric Association, puts these companies in a class of public servants surpassed by none in devotion to the common good.

Regional upbuilding, sound policies in water-power development, wise programs for interstate power regulation, research into the economics of rural-line extension and farm service—all these have received active attention during the short two years of these councils, and real progress has been made toward the solution of many pressing problems. The resources and knowledge of the power industry have been freely placed at the disposal of the New England Council committees, and through extensive publicity the truth about the utilities and their relations to their times has won wide acceptance. At the annual meeting of the conference in Springfield next month we may look for further evidence of good citizenship on the part of the utilities in relation to rural service and interstate transmission, and the willingness of these companies—bred and reared in the pioneer territory of American individualism—to act concordantly through this impartial agency is an index both of fine motives and of public spirit.

* * * *

Maintenance Control in Generating Plants

ERRATIC fluctuations in maintenance cost are common in generating plants from month to month. A recent study of these costs in a large central-station boiler plant indicated little if any connection between monthly output in kilowatt-hours and over-all maintenance expenses. The same thing was true with water evaporated and fuel burned. If this be so, the natural inference is that very little can be done in the way of cost control in the repair field; but we believe the inference is unjustified. The approach to control must be through better records of maintenance cost and their painstaking study, accompanied by the best possible grade of regular inspection, coupled with a policy of constantly taking up the slack in repair jobs and thus keeping the plant in as good condition as possible at all times.

Maintenance control rests on the predetermination of necessary work. Obviously it would be absurd to expect to attain uniformity of outlays from month to month on the basis of present-day knowledge of equipment wear and tear. But in companies where it has been the practice to drift along and to handle plant maintenance as the need became urgent, and perhaps in many cases only after the failure of equipment units (others being in reserve), it would seem possible to establish a far better regulation of repair outlays than hitherto. Straight-line outlays per month are out of the question, but surely progress can be made by more careful planning.

It should not be forgotten that the closer the maintenance control the less becomes the need for reserve apparatus and spare-part investment. There is some danger that interconnection reserves may blind executives now and then to the cost of neglecting local maintenance. Budgets for repairs are bound to show striking variations from month to month when compared with the later actual outlays, but even in the face of uncontrollable discrepancies of this sort it is helpful to rough out a tentative repair schedule, ascertain the reasons for enforced variations and determine whether more systematic and more rigid inspection might have led to better economy. Many generating stations are still a long way from a truly scientific basis of management. The demand for increased net earnings grows apace.

* * * *

High Tribute to John F. Gilchrist

CROWNING the distinguished honors which for years have been paid to him by an appreciative industry, John F. Gilchrist received a splendid tribute this week in the great testimonial dinner tendered to him in Chicago to mark the completion of his forty years of service with the Commonwealth Edison Company. Forty years of service, for a man who seems so young, is in itself a notable achievement. But when these years have built a record of so brilliant a recognition as has been accorded to Mr. Gilchrist, measured both in responsibilities and in influence, it becomes a matter for particular consideration.

As counselor for Samuel Insull in that splendid organization which has carried the development of the electrical industry in the great city of Chicago to such pre-eminence, Mr. Gilchrist would be entitled to a place among the chief men of the central-station world if he had done nothing else. As president of the National Electric Light Association and later of the Association of Edison Illuminating Companies, and by his many other industry activities, he has assumed a position of national leadership such as is won only by proven wisdom and capacity. It is particularly striking, however, that, despite his modesty and the quiet dignity with which

he has carried his heavy burden of affairs, this man today is looked upon as the outstanding exponent of commercial progress in the power industry. Certainly no one has done more than he in recent years to draw the minds of central-station men to the problems of the marketplace and to carry to executive attention the practical aspects of the era of intensive selling upon which the industry is now fast embarking. The earnestness with which he has pursued this theme has made a deep impression on industry thinking.

John Gilchrist has blown no horns to advertise his work. He has placed his reliance rather upon inherent qualities of deliberation, poise, self-control, concentration, analysis, persistency, courage, loyalty and, above all, his astonishing capacity for hard work. He has been faithful far beyond the measure of most men, and he has seen the fruits of his effort in the advancing progress of the great public service to which he so long has dedicated his life. Fortunate it is that this anniversary does not mark retirement or the abatement of so useful and inspiring a career, but rather a spontaneous tribute from his host of friends that after so constructive a contribution he can still continue to give the guidance of his fine example and leadership.

* * * *

Coal-Mine Lighting Intensity Inadequate

WHILE remarkable advances have been made in the ventilation, drainage, haulage, blasting, mining and loading of coal, very little improvement is apparent in mine lighting from the viewpoint of volume of illumination furnished. Authorities have figured out that the amount of light furnished the miner, under average conditions, is only one-thirtieth of that in the factory.

D. C. Ashmead, mining engineer, in a recent issue of the *Mining Congress Journal* says that an entirely new idea of mine lighting is now being developed that will improve conditions to a great extent. This is the floodlighting of the entire working face so that at all times it will be illuminated with virtually the same amount of light to a distance of about 15 ft. back from the face, both the floor and roof being illuminated as well as the actual coal face. With this method the miner is able at all times to observe the actual conditions under which he is working. In one mine where floodlighting has been used it has proved very successful, so much so that fatalities and injuries had been decreased 50 per cent.

There is one objection to this method arising from the lighting wires leading to the floodlamps. There is a slight danger from sparks forming in the lamp sockets. There is a greater danger at all times of rock or coal falling from the roof and breaking the wires, causing sparking which may ignite gas and coaldust. If such a break occurs in the main line, the entire mine is left in darkness. At the present time there is under consideration, experimentation and development a portable lighting unit producing from 100 to 200 candlepower. With two of these placed on opposite sides, shadows can be eliminated and the roof and floor observed at all times. If a fall of rock or coal occurs, only one lamp, if any, is put out of commission, and the mine would be endangered in no way.

Lighting specialists of power companies in coal-mine regions and manufacturing specialists should do everything in their power to co-operate with mine operators to increase the amount of illumination in coal mines. Whether this is accomplished by electricity or some other means is of little consequence as long as the illumination under which the miner works approaches nearer and nearer to the conditions under which the man in the factory works. As better illumination is furnished greater efficiency in mine labor can be looked for, together with a material saving in human life.

* * * *

Broadcasting Over Wires

WHO can predict the future of radio? This modern giant of business and fascinating application of electricity to public service and entertainment seems destined to develop and expand to an extent which cannot be conceived. It is an art and a business which offers almost limitless possibilities.

In this issue General George O. Squier discusses the possibilities of broadcasting over light, power and telephone wires. This idea is not new, but conditions have come about which make a consideration of these possibilities important. Radio channels in the air are limited; wires are used largely in connecting broadcasting stations; in large cities interferences occur and troubles from steel buildings, electrical equipment and static disturbances are encountered; the equipment and methods for wired radio have been developed greatly, and business negotiations are rumored to be under way by which it is expected that wired radio will be used on a commercial scale.

Radio broadcasting as at present conducted has proved to be a needed and welcomed service and will continue to be used. Wired radio is a supplementary service which should make for the more effective use of all radio facilities. The equipments and methods used in radio broadcasting are essential elements in wired radio development, and the only radical change in present practices lies in the proposal to use wires for the last mile or two of the present broadcasting transmission system. It will be commercially impracticable to use wires to all the millions of homes, and the fact that wired radio is proposed as a service to be paid for by subscribers will insure that air broadcasting service will continue to be used. Moreover, technical difficulties in sending high-frequency energy over cables any great distance at a reasonable cost will limit the use of wired radio to metropolitan areas of rather heavy service density.

The advent of wired radio should be welcomed by the entire electrical industry. It will make more service channels available for broadcasting and permit the Federal Radio Commission to allocate the broadcasting channels more judiciously. It offers to light and power and telephone utilities a new type of business which should increase earnings on existing investments and which should enable them to improve their public relations. It will afford the public a radio service of high quality and perhaps permit new services to be rendered American homes through other inventions and discoveries. Much work remains to be done before wired radio becomes a going concern, but there is no doubt that its commercial possibilities will be grasped by the electrical industry.

It must be remembered, however, that, imminent as the commercial application of wired radio may be, its greatest usefulness will probably come as a supplementary service to space broadcasting. For it will undoubtedly tend to stimulate the radio industry to the continued growth and development of its service to the public.

The Best Way to Tell the World

UNDOUBTEDLY there is confusion in the public mind as to the true character of the power industry. The growth and magnitude of interconnection and the growth and prosperity of operating and holding companies have come so rapidly that the inherent human fear of things that are big has crept into the situation. And people ask themselves, "Is it all right?"

The thought has been seized by the proponents of government operation and federal regulation and by political adventurers and distorted to their purposes by broad claims based on the citation of isolated instances that as a matter of fact are in no wise either typical or symptomatic. Out of this has come an agitation for congressional and state investigations, and in the interest of truth it has become highly important that a clear contrast be drawn in the public mind between the few apparent black spots in utility management and the broad record of honest, intelligent and efficient public service that has so characterized the splendid development of the great power systems of the United States.

THE public is entitled to have this all made clear and this has been the moving impulse of the public relations work that has been so successfully conducted in the power industry in late years. It has been the obvious motive behind the very constructive activities of the state public utility information bureaus that have been at work in all parts of the country.

But in all of this activity one fact has stood out most impressively yet without receiving any particular attention. In their enthusiasm to tell the world about their business the power companies have almost entirely neglected their greatest available educational resource, which is the intelligent, eager-minded support of the vast personnel of the electrical industry itself.

Employed in the full ranks of the electrical industry are more than a million men and women. They are distributed among power systems, manufacturing plants, wholesale distributors, wiring contractors, dealers and miscellaneous electrical businesses. Each of these men and women is in intimate contact with a circle of his or her personal friends and acquaintances with whom he or she talks. So it is with the employees of the gas and street-railway industries. No one of them is so humble but that he has a vote, a voice and an influence among his neighbors that, whether he realizes it or not, is either positive or negative. By his personal confidence in the economic superiority of the private operation of these public utilities, expressed by the things he knows and tells them in the ordinary course of casual conversation, he strengthens their confidence in it also. Or, to the contrary, by his lack of facts, his absence of assurance, or his observable pessimism or apparent suspicion that something must be wrong, he actually undermines the public's confidence in its utilities and without meaning to. The greatest opportunity in the present situation lies in this direction.

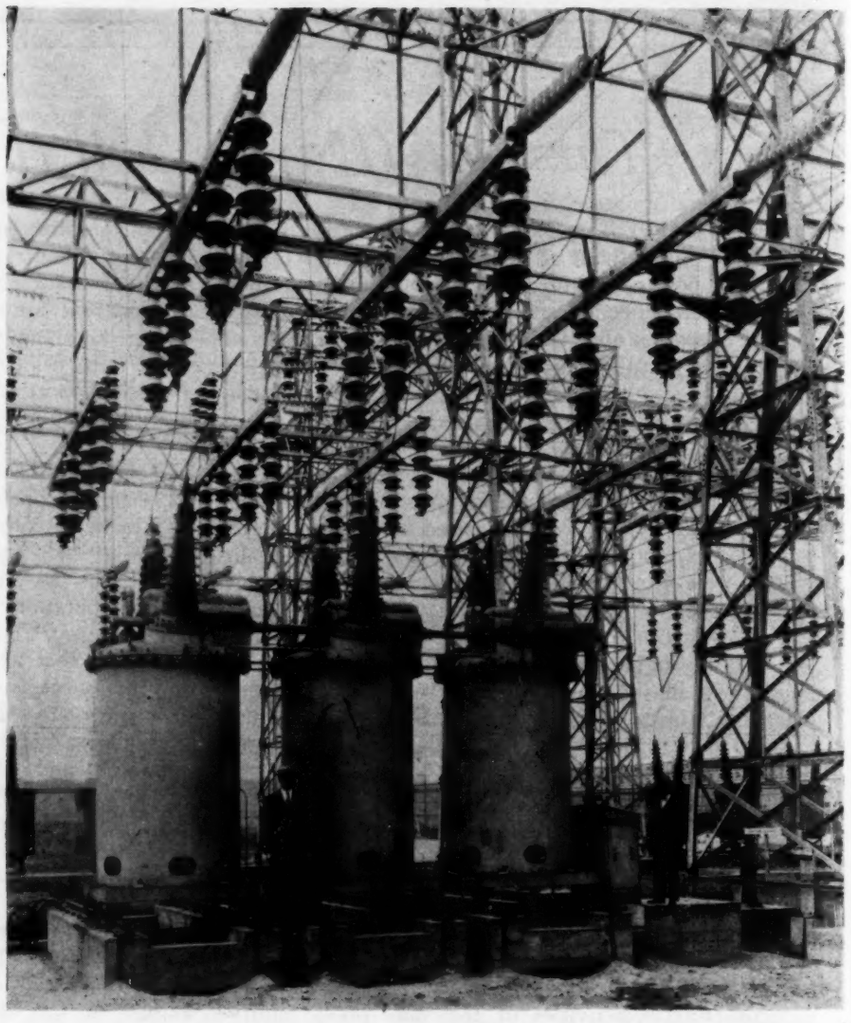
THE proponents of federal regulation and government operation in whatever efforts they may make to convert Congress and the American people to their way of thinking must make a case against the present system of state regulation and private operation. To make a case they must present evidence. To present evidence they must obtain facts that appear to prove the point. And they undoubtedly will get such facts by seeking them in isolated situations where either exceptionally efficient municipal operation or exceptionally inefficient and short-sighted private operation provides the arguments they want, either in statistics or in public testimonials or in both. To protect the public and defend the principles that underlie the splendid development of public utilities accomplished under the operation of highly specialized private management, the true picture must be made plain, based not on ingeniously selected isolated cases, but upon the broad resources of fact that are typical and true of the industry as a whole.

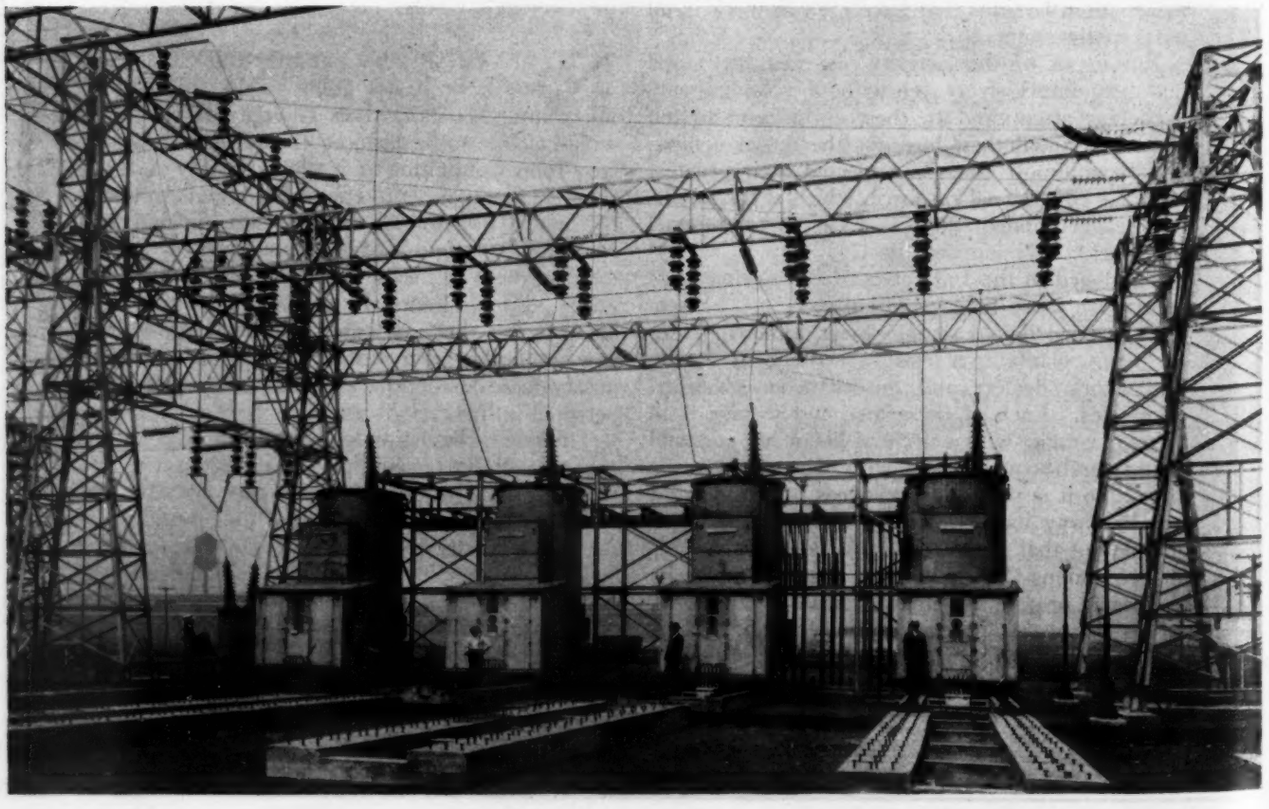
NO MATTER what one may think that Congress is or is not going to do, this issue is important. If not, then George B. Cortelyou would not now be heading the recently reorganized Joint Committee of National Utility Associations and preparing to conduct a broad campaign of public information. Such a campaign will spread much light and do much good. But so long as there is darkness in our own minds this effort is foredoomed to but a fragment of the achievement that might be possible if the million and more men and women of the electrical industry were also atune and daily exercising their personal influence.

The frank conviction well expressed of a million personal friends who know the facts can and would automatically argue the case for the efficiency of the private operation of public utilities in the living rooms of the very people who send the legislators down to Washington. These friends, once they have the facts and realize the importance of the issue, will become the teachers of the people. Their help will accomplish more than all the brave words about the power industry that can be printed during six sessions of Congress.

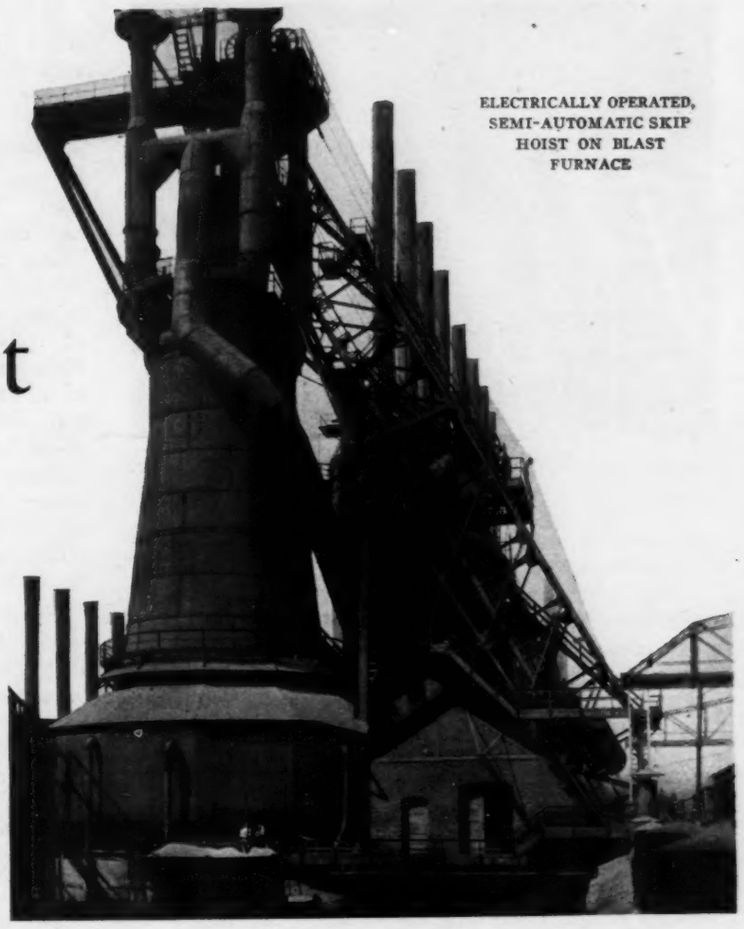
Waukegan's 132-Kv. Substation in Service

WITH the 50,000-kw. plant addition at Waukegan, the Public Service Company of Northern Illinois put into service the first units of the permanent 132-kv. substation which is the connection point of the Chicago metropolitan district system with the Milwaukee company and others north. The present installation consists of two transformer banks, one of 30,000 kw. and the other of 60,000 kw., and three 132-kv. lines. Each bank includes a spare transformer. The 60,000-kw. bank is equipped with load ratio control, the tap changing being accomplished by the single-winding method using sections of the star-connected primary adjacent to the ground point. The ultimate installation will include seven transformer banks and ten 132-kv. lines.





Power Application in Steel Plant



ELECTRICALLY OPERATED, SEMI-AUTOMATIC SKIP HOIST ON BLAST FURNACE

New merchant mills in Gary works of the Illinois Steel Company exemplify modern practice. Highly developed methods speed production and improve quality of product

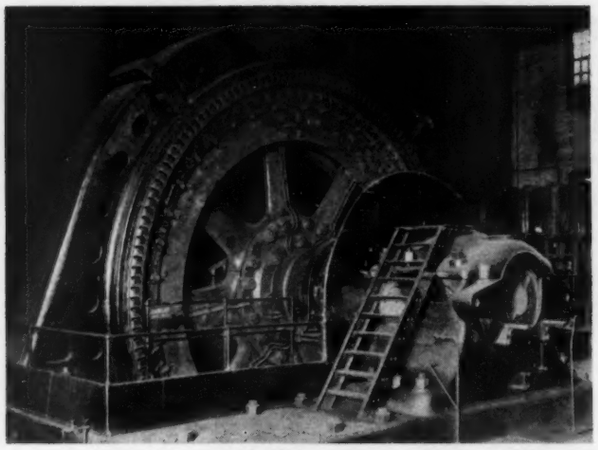
IT IS probable that no one element has contributed so greatly to the development of high speed and large production in the steel industry as has electricity. And in the bending of electric power to the manifold and diversified labors of steel making, engineering skill and inventive genius have been conspicuously displayed, whether the application has been of a motor of many thousand horsepower or of one having a fractional rating. Many pages could be written on the ore-unloading docks; on the devices for feeding the raw material to the blast furnaces, on the drives of the mills, and on the cranes and other material handling arrangements that are everywhere in a steel plant. However, in this article perhaps it will suffice to present a somewhat detailed description of just one important element in a steel mill.

In the Gary works of the Illinois Steel Company, which is a subsidiary of the United States Steel Corporation, there are two new installations which, at the time of writing, are not yet fully completed but which, when this article appears in print, will probably be producing. These installations are the 10-in. and 9-in. merchant mills,* which have many new features worthy of note. Only the 10-in. mill, which is nearer completion than the other, will be described, as its general design and layout almost duplicate those of the 9-in. mill.

In the past, before electric mill drives had reached their present state of development, the conventional practice was to lay out the position of the rolls in the mill so that when the steel had been reduced in size to permit of handling, a man would catch the end of a piece coming out from a pair of rolls with a set of tongs and by quick action insert the end into the next set of rolls before a swiftly moving loop of hot bar could entangle itself. Although it was possible then for the mill to be so designed that each succeeding set of rolls ran, by means of gear trains and belts, at a faster speed than the one before, yet these speeds were fixed or varied only with difficulty, and much space had to be allowed for the steel to loop between rolls in order to compensate for the invariability of the roll speeds. However, with the modern systems of control of motor speeds, each set of rolls may be rotated at such speed as to keep the loop of steel between rolls of almost exactly unvarying dimensions.

In the mill which was first installed all of the roll drives are taken from a single large motor, the rolls being arranged on the floor area side by side in rows with sufficient space between rows so that the metal may be looped out of one stand of rolls into another by hand. This work, performed by men called "catchers," requires agility and skill and cannot be performed continuously by the same crew of men throughout a shift. Two crews are provided, working and resting in alternate twenty-minute periods. With this type of mill there is a definite upper limit of speed at which the metal may pass through the rolls. This limit is in the neighborhood of 1,100 ft. per minute. Above this speed the human hand and eye cannot be depended on to grab the end of the steel as it emerges from one set of rolls and insert it properly in the next stand. Newer mill installations were determined then by these considerations of roll locations and roll speeds, the objects being to simplify the arrangements of the parts of the mill and to increase output. These objects were obtained in various degrees in succeeding installations. The sizes of loops were reduced and roll speeds were increased by the use of guide channels which carried the end of the metal from one roll to another. These channels were devised so that the steel could leave

**Produce merchantable shapes, these being round and square rods, flat strips, angles, I-beams and other intricate shapes that are articles of ordinary commerce.*



6,500-HP., TWO-SPEED, 6,600-VOLT, 25-CYCLE, THREE-PHASE MOTOR ON 60-IN. PLATE MILL

them and the loops enlarge as the cumulations of roll speed differences affected the loops.

However, it was not until closely adjustable individual drives were applied to the higher speed rolls that the simple arrangement of setting all of the rolls in a single line was reached, thus permitting marked increase in roll speeds and as marked decrease in floor area covered by the mill.

Arrangement to Save Labor and Space

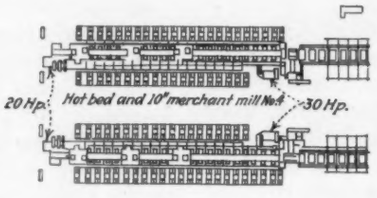
Connected with the 10-in. merchant mill at the Gary works are five operations or phases of operation: The loading mechanism, which receives the steel billet from the yard by means of a crane; the furnace, in which the billets are heated to working temperature; the rolls, which perform the actual work of size reduction; the hot bed, which receives the product of the rolls and permits it to anneal in cooling when required, and the shear and gage, which cut the strips and bars to the desired length. Located in the center of the charging table is a ram operated by a 7-hp. alternating-current motor, which pushes the billets, one or more at a time, into one end of the heating furnace. This furnace is fired with coke-oven gas; it is sufficiently wide to accommodate 30-ft. billets, which are pushed through the furnace by means of electrically operated pushers. As the billets are discharged out of the side of the furnace they pass through a billet shear, where they can be cut to shorter lengths if required in order to obtain the desired length of finished bar.

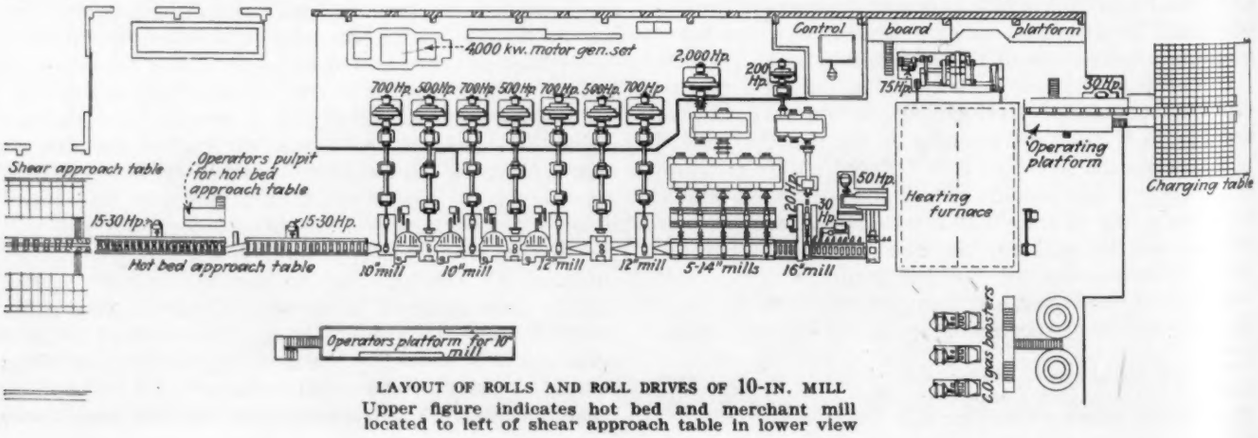
After the billet leaves the shears it is conveyed by roller table to the first stand of rolls. This stand consists of two-high, 16-in. diameter rolls independently driven from the succeeding five stands by a direct-current motor. The arrangement makes it possible that the reductions between this stand and the succeeding stand can be varied to accommodate the size billet or slab being used. The next five roughing stands have 14-in. diameter rolls and comprise passes Nos. 2 to 6 inclusive. These stands are spaced on about 6-ft. centers and are driven by a combination of helical tooth gears completely incased and having modern lubrication. These five stands of rolls are all driven by one direct-current motor. Following No. 6 stand of roughing rolls are two stands of 12-in. horizontal rolls, three stands of 12-in. vertical rolls and two stands of 10-in. horizontal rolls, all spaced about 12-ft. centers and independently driven by direct-current motors. The stands are located in the following order: No. 7, 12-in. horizontal; No. 8, 12-in. vertical; No. 9, 12-in. horizontal; No. 10, 12-in. vertical; No. 11, 10-in. horizontal; No. 12, 12-in. vertical, and No. 13, 10-in. horizontal.

Between stands Nos. 9 to 13 there are specially designed looping arrangements. These loopers are such that they will accommodate bars of any section rolled on the mill and are so designed that the bars can be looped either downward or sidewise as desired. Owing to the speed at which the loopers operate, considerable study was given the design of the looper drive in order to operate it electrically. The operation of these loopers is described more in detail later.

Vertical Roll Equipment Is a Feature

The most modern and the unique feature of this mill is the specially designed vertical roll equipment. In the past, vertical rolls have usually been used only for edging flats where only a slight reduction or amount of work is necessary. In designing this mill the vertical roll stands and their drives have been constructed heavy enough and provided with sufficient motive power to permit their doing the same amount of work as is required of the adjacent horizontal stands. By the use of these vertical rolls and the specially designed loopers, rounds or squares can be rolled through these stands without twisting, eliminating the possible chance of scratches or defects developing from guide equipment. The vertical roll housings are so constructed that the rolls can be readily changed without consuming any more time than is



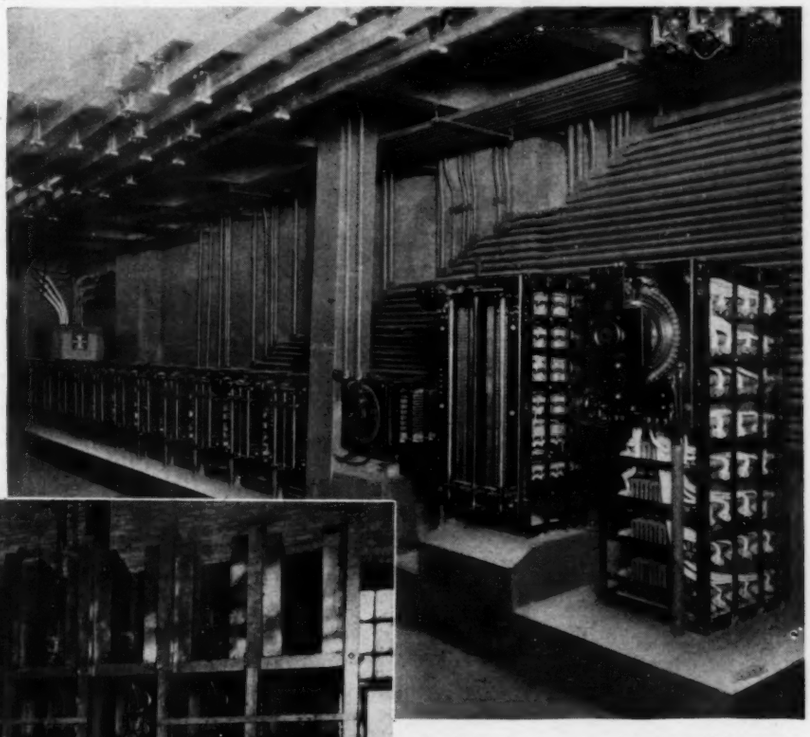


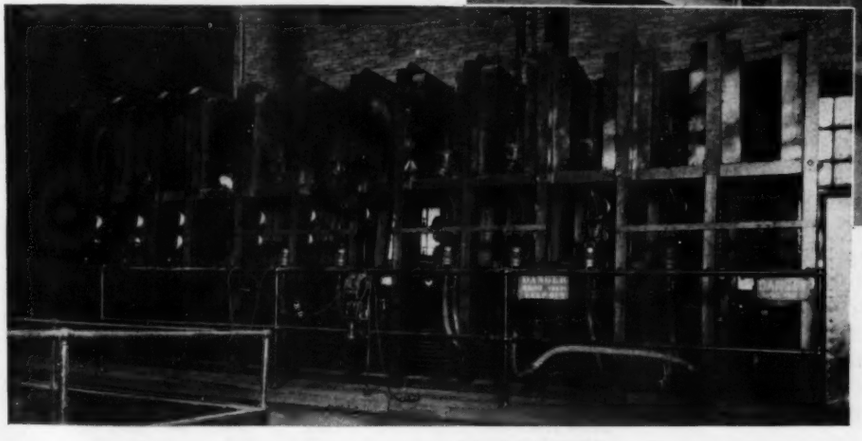
LAYOUT OF ROLLS AND ROLL DRIVES OF 10-IN. MILL
Upper figure indicates hot bed and merchant mill located to left of shear approach table in lower view

ordinarily required to change a set of horizontal rolls. The vertical pinion housings are located beneath the mill and are designed to protect the pinions and all moving parts from water and mill scale.

The finished bars, on leaving the rolls, pass on to the hot bed, which is 450 ft. long and is of the double gravity escapement type. The steel passes along the top of the hot bed on 150 double rollers, each driven by a ½-hp. motor. After the finished bar is completely on the bed, apron plates between the rollers are raised to stop the bar and it is then kicked off into a receiving trough, from which it is lifted by a movement of the rack bars and is gradually transferred down the incline of the bed as the succeeding bars come from the mill.

The sloping sides of the bed are made up of rack bars which have a series of fingers spaced to give an advance of 7½ in. each time the rack bars are rocked. These rack bars on either side of the bed are all connected and operated by means of a motor drive. About half the length of the bed at the head end is equipped with an arrangement by which flat bars can be stacked on edge alongside one another in a continuous manner; after a certain number of bars have been stacked they are taken away by the shuffle bars as they continue to be stacked from the other side. This procedure allows slow cooling, which anneals the material as may be needed for spring steel and strips.





ABOVE—BASEMENT OF MOTOR ROOM, FIELD RHEOSTATS IN FOREGROUND

AT LEFT—AIR-OPERATED 6,600-VOLT CONTACTORS CONTROLLING 6,500-HP. MOTOR ON 60-IN. PLATE MILL

After cooling, the bars are carried over laterally by means of shuffle bars to the roller tables, which convey them to the shears at the ends of both sides of the hot bed, where they are cut to the lengths required. The back-shear tables and gages will handle material up to 60-ft. lengths. These back-shear tables are equipped with three gages each, as may be seen from the illustration.

Roll Motors and Control

The total number of motors in this one mill runs well over 200. All of the motors, with the exception of the roll drives and the hot-bed approach table, are 25-cycle, 220-volt, three-phase, alternating-current units. The roll drives are direct-current motors, which are started by Ward-Leonard control.

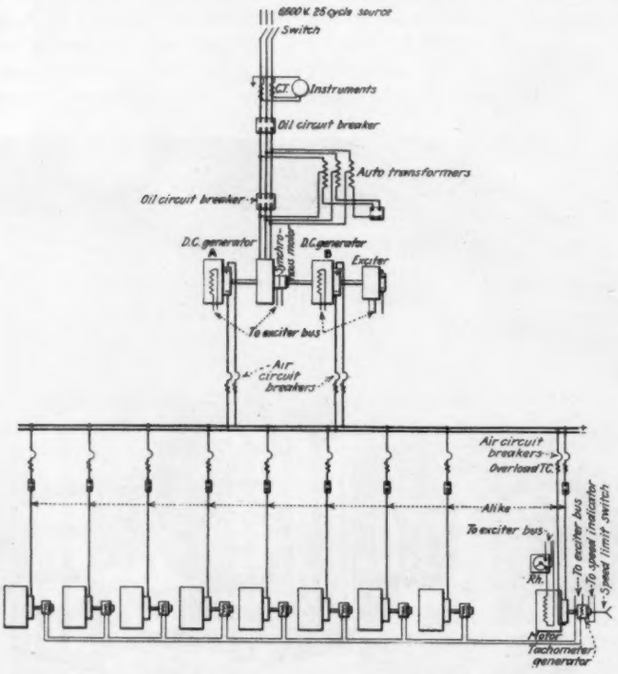
The first set of rolls is driven by a 200-hp. motor through a helical gear reduction train. The next stand of five rolls is driven by a 2,000-hp. motor through a gear reduction and the sets of rolls are coupled together by helical gears. It is interesting to note that all of the gears driving the five sets of rolls are mounted in an oil-tight gear train in a single casting about 30 ft. long, thus insuring the continued accuracy of gear alignment. The remaining seven sets of rolls in the mill are driven by individual motors directly connected to the rolls, the motors on the horizontal rolls being 700 hp. and on the vertical rolls 500 hp.

The armatures of all of these roll drive motors are connected through air-break switches to a bus, which is fed from a 4,000-kw. motor generator set consisting of two direct-current 600-volt generators and a synchronous motor mounted on the same shaft. The reason for two generators is the limitation of size at the operating speed. Also on the shaft of the motor-generator set is the exciter which furnishes the field current for the direct-current generator and for the motors.

Speed control of the motors is afforded by motor-driven rheostats which are in series with lever-operated rheostats. Both of these rheostats have 120 points, thus permitting a speed control for each motor in 14,400 steps, covering a wide range of speed for each set of rolls. This range of speed variation is necessary on account of the differing characteristics of rolled material. The control of these motors is concentrated in an operating board which is located in a pulpit from which the operator can watch closely the passage of the steel through the mill. The air breakers through which the various motors are connected to the direct-current bus are so interlocked that it is impossible to close them with voltage on the main

direct-current bus. Only those motors may operate which are connected to the bus before the field switches on the generators are closed.

All of the motors are equipped with electric tachometers consisting of small generators operating with a constant field energized from the exciter bus of the system. Since the field is constant, the voltages of these small generators will be directly proportionate to their speeds. Variations in the exciter bus voltage will of course affect the indications of the tachometers, but all



SIMPLIFIED DIAGRAM OF MOTOR-GENERATOR AND ROLL-DRIVE MOTOR CONNECTIONS

will be affected in like degree, and since only the differences in speeds between the different motors are of importance, variation of exciter bus voltage may be neglected. Each motor panel in the control pulpit is equipped with an ammeter, a tachometer voltmeter for that particular motor, remote control of the motor armature circuit breaker and field control of the motor. Also in the pulpit is located the direct-current control of the motor-generator. During actual operation of the mills the operator is concerned only with the field control of the motors, since the main switch is closed before the system is started.

Motor and Control Segregation

The direct-current motors that drive the rolls, the motor-generator set and the auxiliary apparatus pertaining to them are housed in a sheet-steel room built just inside the wall of the mill structure. This room is wholly inclosed so that the electrical equipment contained in it is protected from mill dirt. The motor and generator field rheostats and alternating-current feeder switches are in the basement of the motor room, as are also the 500-hp. motors driving the vertical rolls, the floor of the room above being cut away over these machines. To cool the electrical equipment a blower installation brings air from outside through a filter and discharges it into the basement. Below the rotating machines shutters are located so that the cooling air may be controlled for each one. Since the air pressure inside the motor room is slightly higher than outside, no air-borne dirt or dust can enter.

The whole system is supplied with relays to guard against any conditions of trouble that might arise in the motors, generators or control arrangement. All switching and control devices are interlocked with one another in such manner that proper sequences of operation must be followed out in their entirety to get the system into operation and to keep it going. This is a very essential condition for proper operation of the mill, because if any one set of rolls stops while the others are operating, it does not take long for the steel from the preceding roll to pile up, causing a delay before the mill can get into operation again. Since the output speed of the steel coming from the last roll approaches 1,800 ft. per minute and is running along at fixed speeds below that throughout the whole length of the mill, it may readily be appreciated that a stoppage anywhere along the line will cause trouble and that very quickly.

Operation of Looper Drives with Different Stocks

The "loopers," earlier referred to, which are located between the last five stands of rolls, consist of semicircular bed plates laid horizontally, on which are arranged the triggers, stops and guides that permit the metal to loop between adjacent sets of rolls. Since this mill may be set up to produce various sections, the loopers are devised to perform their functions in a different manner for each case.

When "rounds" are rolled, the looper bed plate remains stationary and the loop is permitted to form itself horizontally on the surface of the plate. The loop formation is accomplished by means of a vertical roller which gives the steel a push in the direction in which the loop is to be formed after the head end has been inserted in the receiving set of rolls. The steel coming from the first roll goes through a guide channel on the surface of the plate, the end of it striking a trigger just before it emerges from the end of the channel and enters the next roll. The time elapsed between the release of the trigger and the action of the roller is sufficient for the end of the steel to enter the second roll. One side of the entrance

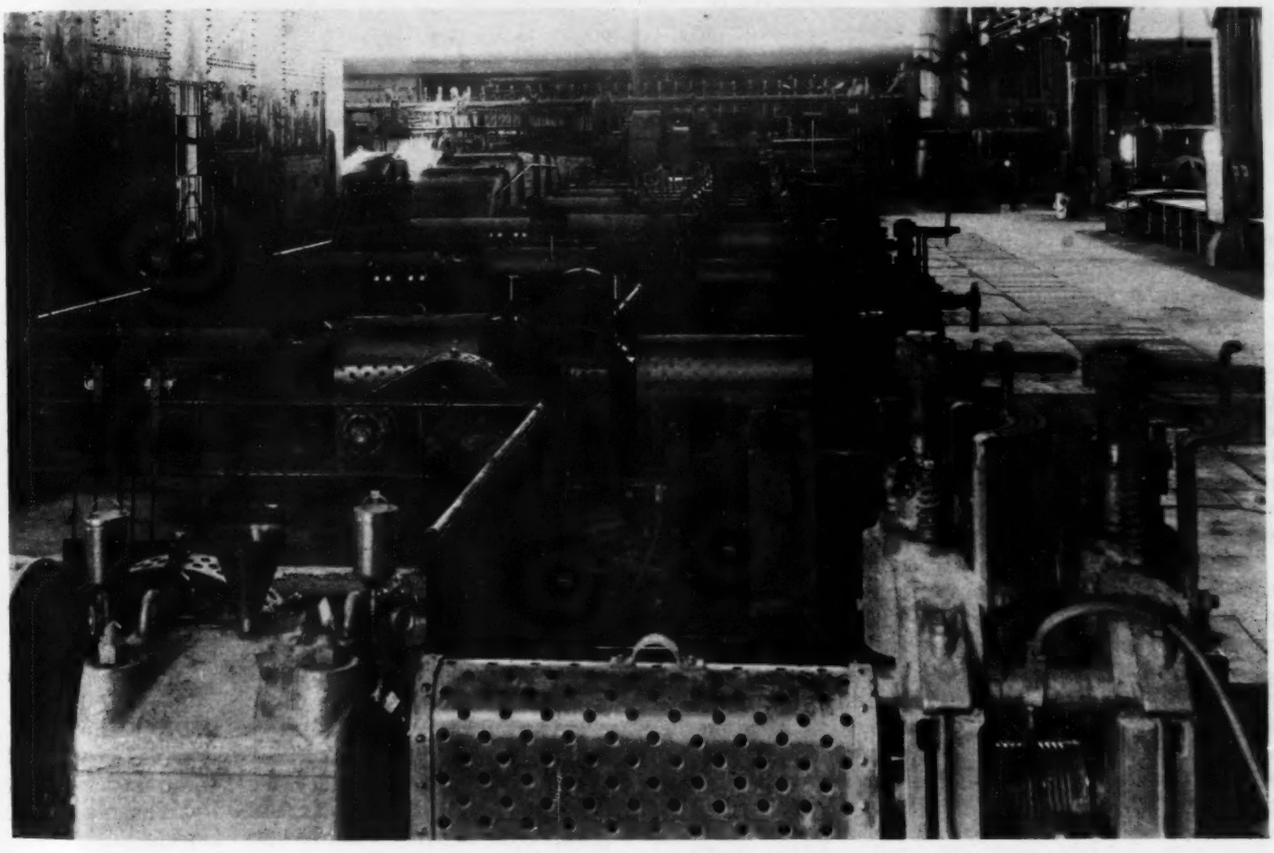
RATINGS OF MOTORS USED WITH 10-IN. MERCHANT MILL

Application	Hp.	Type	Voltage	R.p.m.	Number
Charging table	30	S.R.	220	750	1
Furnace charger	7	S.R.	220	750	1
Billet pusher	75	S.R.	220	500	1
Pinch roll	30	S.C.	220	750	1
Furnace shear	50	S.C.	220	500	1
Furnace runout table	30	S.R.	220	500	1
Rough roll	200	D.C.	600	240/900	1
Intermediate table	20	S.R.	220	750	1
Roll passes Nos. 3, 4, 5, 6	2,000	D.C.	600	315/500	1
Horizontal rolls Nos. 7 and 8	700	D.C.	600	130/310	2
Horizontal rolls Nos. 9 and 10	700	D.C.	600	210/660	2
Vertical roll No. 1	500	D.C.	600	130/310	1
Vertical rolls Nos. 2 and 3	500	D.C.	600	15/550	2
Loopers	85 ft.-lb. at 1-ft. radius	S.C.	220	..f.....	4
Runout tables (hot bed approach)	15/30	D.C.	220	450/900	2
Gas boosters	200	S.C.	220	500	1 and 1 spare
Hot bed conveyor tables	50	S.R.	220	500	4, 2 in parallel
Shuffle bars	30	S.R.	220	500	2
Eccentric lifts	20	S.R.	220	750	1
Eccentric bars	50	S.R.	220	750	2
Apron lifts	20	S.R.	220	750	2
Kick-offs	12	S.R.	220	750	2
Stack pushers	30	S.R.	220	500	2
Stack support fingers	20	S.R.	220	750	2
Rack bar drives	20	S.R.	220	750	2
Cobble coiler	30	S.R.	220	500	1
Shears	50	S.R.	220	500	2
Gage stops	10 ft.-lb. at 1-ft. radius	S.C.	220	.....	6
Gage stop carriage	7½	S.R.	220	750	6
Shuffle bars, dist. bldg.	20	S.R.	220	750	2
Coaster bar lifts	12	S.R.	220	750	2
Hot bed rolls	0.17/0.50	S.C.	220	285/750	150

end of the guide channel is cut away in a slope so that the roller easily starts the steel out of the channel to form the loop. While one piece of steel is going through, the roller remains in its second position. When the last end of the piece is clear of the looper, the operator closes the switch on the motor, which compresses a spring, bringing the roller back to its first position and setting the trigger for the next piece to come through.

When flat strip is being rolled, it is, of course, not possible for the loop to be horizontal, since the strip itself is in the horizontal position. With this set-up, the looper table is pushed back, removing the channel for rounds or squares out of line with the rolls and bringing the flat channel into line with them. The section of this channel looks somewhat like a tuning fork laid on its side. The end of the fork is closed by a stationary bar running the whole length of the channel. A flat piece goes through this channel and strikes a trigger in the same way as does the round. But this trigger causes the whole table to move back, thus pulling the fork away from the strip and permitting it to loop down into the pit between the rolls. It is not practicable to use the ordinary type of motor for this kind of service, since in both methods of using the looper the motor must be stopped after the parts have made a certain travel. It would seem natural to fulfill this condition by the use of a limit switch on an ordinary motor, but this is not practicable on account of the very short cycle of operation and the fact that the parts must be stopped and held absolutely without rebound from the stops, as would happen if the motor were off the line and had no torque. Therefore the motors on the loopers are designed to stall and remain connected across the line when the moving parts have reached the end of their strokes. A time-limit relay is connected in each motor circuit so that it will not remain across the line for an indefinite time after an operating cycle is completed. This motor functions much like a solenoid magnet, the reason for the use of a motor instead of a magnet being that the latter would have to be inordinately large to perform the work.

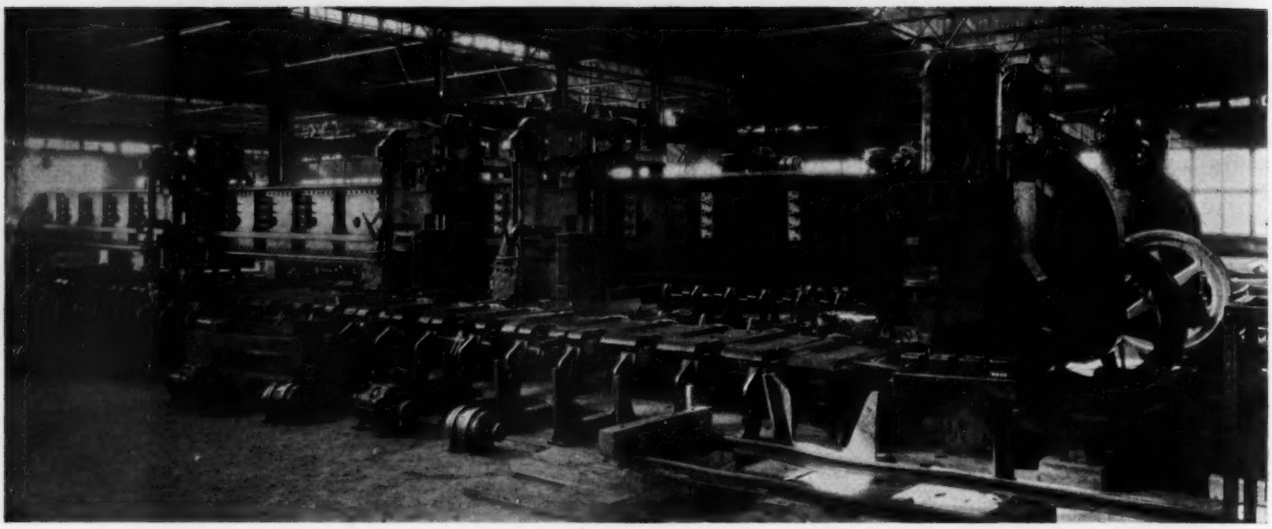
When rounds are being rolled, the steel is guided so that it will squarely enter the pass in the finishing rolls. Without this a slight lateral deflection of the metal as it enters the pass would result in a deformation of the finished product. On the older mills, running at lower speeds, the guide is opened to receive the end of the steel and after it has entered the rolls is closed by means of a hand-operated lever. On this high-speed mill, however, manual operation is too slow and the guide is equipped with a solenoid-operated mechanism controlled by the trigger of the looper.



ROLL STANDS OF 10-IN. MERCHANT MILL
Furnace in background and motor room at left. Top roll of finishing stand visible in lower right corner

Hot Bed Speed Control and Shear Drive

In describing the hot bed, mention was made of the conveyor rolls which carried the steel along the top of the bed after it had been discharged from the mill. It is desirable that these rolls should rotate at a speed in conformity with the discharge speed of the mill; a very simple system of speed control is used. In the main motor room there is a small alternating-current generator driven by an adjustable-speed direct-current motor, the motor being connected into the 600-volt system. The alternating-current generator is a simple four-pole machine designed for normal 25-cycle output. All of the



SHEAR AND GAGE TABLE

150 ½-hp. motors in the hot bed conveyor rolls are connected across the output terminals of this alternating-current generator. By varying the speed of the direct-current motor driving the generator it is possible to get a frequency range in the alternating-current output of from 7½ to 25, or a little higher, cycles per second. Since the speed of the roller motors is proportional to the frequency of the current supplied to them, it is apparent that the speed of these rollers may be entirely controlled by field control of the direct-current motor driving the alternating-current generator and that this may be accomplished over a fairly wide range of roll and motor speeds.

As earlier stated, each shear and back-shear table is equipped with three gage stops for measuring the finished product to the proper lengths. These three stops are carried on a bridge extending over and lengthwise of the gage table itself. These stops are moved along on this bridge by means of a rack and pinion, the rack being on the lower side of the bridge and the pinion carried on the gage stop and being driven by a motor mounted on the stop and controlled by a drum controller so that movement may be had in either direction. The actual stops against which the steel butts as it runs between the jaws of the shear are brought down on to the gage table by a worm and crank motion which is operated by the same kind of motor as works the looper.

As may be inferred, the 10-in. merchant mill and its sister, the 9-in. merchant mill, mark very distinct advances in the art of steel manufacture. They furnish illuminating and inspiring examples of that distinctly electrical contribution to modern industry, the gradual elimination of human participation as a mechanical element in processes of production.

Generates at 5.16 Mills Per Kilowatt-Hour Gross

IN 1925 a 40,000-kva. main generating unit and three 1,492-hp. boilers were installed at an Eastern tidewater central station burning fuel oil. Operating results are now available for this plant for 1926. Despite the fact that only the first unit of the station was in service throughout the year, the net cost of production, exclusive of fixed charges, was but 5.16 mills per gross kilowatt-hour delivered at the bus. During this period

MOTOR-GENERATOR SET AT RIGHT (700 HP.), HORIZONTAL ROLL DRIVE MOTORS AT LEFT (500 HP.), VERTICAL-ROLL DRIVE MOTORS IN PITS BETWEEN THE OTHERS

OPERATING COSTS OF 40,000-KVA. CENTRAL STATION
Year 1926. Cents Omitted

Operation:		Maintenance:	
Superintendence	$23,358	Station structures	$2,472
Boiler labor	14,278	Boiler plant equipment	13,930
Turbine labor	21,630	Turbo-generating equipment	2,515
Electrical labor	21,025	Electrical generating equipment	58
Miscellaneous labor	12,095	Accessory electrical equipment	3,208
Boiler fuel	576,107	Miscellaneous power plant equipment	1,672
Water for steam	2,883		
Lubrication	1,764		
Station supplies and expenses	13,419		
Total operation	$686,564	Total maintenance	$23,855
Total operating and maintenance			$710,429

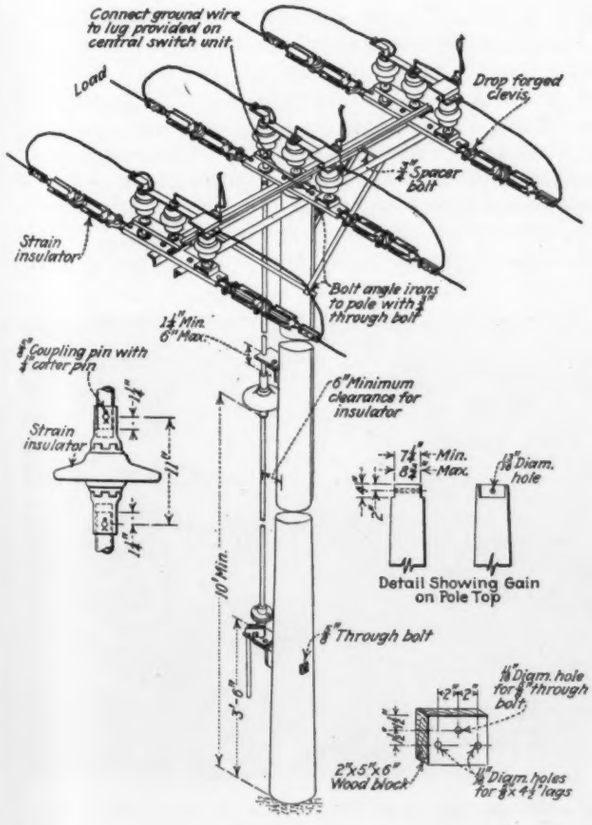
the plant burned 328,790 bbl. of fuel oil at a cost of $1.752 per barrel. The total net operating expenses of the station were $710,429, fuel cost representing 81 per cent of this, or about 4.2 mills per kilowatt-hour.

The plant, which has reinforced concrete foundations, brick walls, steel frame and gravel roof, contained sections with the following dimensions: Boiler house, 162x134 ft.; turbine hall, 192x67; screen house, 30x20; electrical bay, 96x28; office, 57x25; transformer repair house, 42x32; pump house, 19x24.

Itemized operating costs are given in the table above.

6,900-Volt Pole-Top Switch

Standards of West Penn System


Connect ground wire to lug provided on central switch unit
Load
Drop forged clevis
¾" Spacer bolt
Strain insulator
Bolt angle irons to pole with ¾" through bolt
1¼" Min. 6" Max.
⅝" Coupling pin with ¼" cotter pin
6" Minimum clearance for insulator
Strain insulator
7½" Min. 8½" Max.
1⅛" Diam. hole
Detail Showing Gain on Pole Top
10' Min.
⅝" Through bolt
1⅛" Diam. hole for ⅝" through bolt
2"x2"
3'-6"
2"x5"x6" Wood block
1" Diam. holes for ⅝"x4½" lags

THE operating shaft of this 6,900-volt switch consists of two sections of 1¼-in. galvanized iron pipe with two $\frac{9}{32}$-in. holes drilled for ⅝-in. coupling pins, 1¼ in from the top of the upper section and 1⅛ in. from the bottom section. The abutting ends are to be connected with a strain insulator as shown in the detail drawing. Poles upon which these switches are mounted must be storm guyed. Guys in direction of line may be head guys.

Removing Errors from Short-Circuit Tests

Miscalculations of energy and power values in many computations. Oscillographic methods provide correct data

By C. L. Kasson
Superintendent Department of Standardizing and Testing, Boston Edison Company

SCIENTIFIC knowledge has progressed so rapidly in the last few years that one may be pardoned for wondering if we do not sometimes overlook simple but very fundamental things. Thus, in testing switches, fuses and strings of insulators, we sometimes quote the source voltage, the current flowing on short circuit and

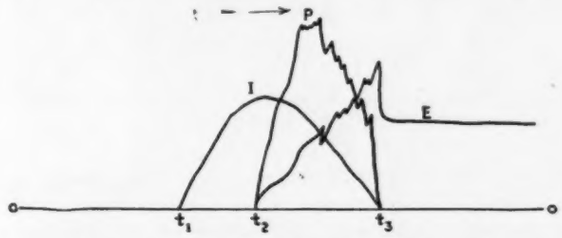


FIG. 1—OSCILLOGRAM OF OPENING OF DIRECT-CURRENT CIRCUIT BY FUSE

then multiply them together to obtain the power. This fictitious value of power is much greater than the real value. An observer of a short-circuit test, seeing the size and intensity of the arc, often cannot reconcile the actual with the supposed effects.

The destructive effects produced in electrical apparatus by short-circuit tests are largely dependent on the amount of heat liberated at the given point, and this is the equivalent of the electrical energy involved. This again is a question of time and power; the latter is the product of amperes, volts and the time relation between the two.

In many ordinary tests, the time period is what is called instantaneous; thus it is only necessary from the practical aspect to consider the power input in relation to the physical effects produced in the apparatus under test. The difficulty is that the power is not the source voltage multiplied by the current flowing either at the time of test or in the closed circuit prior to the test.

In making up a test circuit, some form of additional reactance or resistance is included so as to limit the flow of current in the circuit to a predetermined value. During the usual predetermination of current, the apparatus under test is out of the circuit or has a jumper around it. There is, under this test, no appreciable voltage across the gap where it is proposed to introduce the apparatus to be tested or across the jumper.

When the actual breakdown or short-circuit test is made, the source voltage is divided between the limiting reactors and the apparatus under test. The relative proportions will vary from nearly full to zero voltage across the tested apparatus. At the instant of closing the circuit the apparatus under test may receive nearly full

voltage, but only for an infinitesimally short time. With the initial rush of current, the voltage is reduced below that of the source, and when full current flows, the voltage across the apparatus under test is nearly zero.

Typical Fuse Test

The true relations of voltage and current can be determined only by oscillograph records. Fig. 1 shows a typical relation of voltage and current in a direct-current test circuit during a short-circuit test on fuses. The current I is zero to start, begins to rise when the test switch is closed at t_1, reaches a maximum at time t_2 and subsides to zero at time t_3, when the fuse opens the circuit. The voltage is zero across the fuse at time t_1,

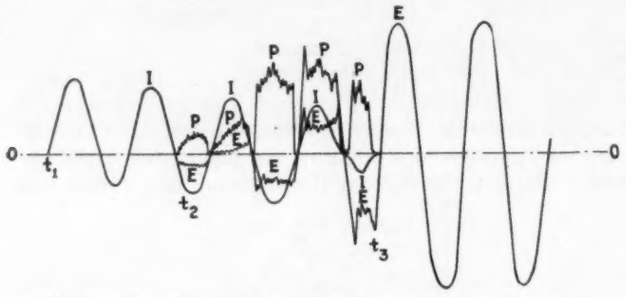


FIG. 2—OSCILLOGRAM OF OPENING OF ALTERNATING-CURRENT CIRCUIT BY OIL BREAKER

begins to rise at t_2, reaches a maximum at time t_3, and then subsides to the source value E after time t_3. The fuse blowing and arc take place from time t_2 to time t_3. It will be noted that source voltage E and full current I do not occur at the same time.

Power is shown by the curve P and is in phase with the arc voltage across the fuse from time t_2 to time t_3. The maximum value of power occurs between the current and voltage maximum values. The integration of the area under the power curve is a measure of the energy and therefore of the total heat at the fuse during the test.

Alternating-Current Circuit-Breaker Test

Fig. 2 shows an analogous case for alternating current. In this case an automatic oil circuit-breaker under test is closed on a short circuit and full line voltage is suddenly applied to the combination through the medium of another breaker. At the instant voltage is applied, t_1, the voltage across the automatic breaker is zero. Current immediately begins to rise, as shown by I, reaching a peak value determined by the constants of the circuit and the particular point of the voltage wave at which the voltage is first applied. In other words, the current is the sum of an alternating component, to which it tends to settle down after a few cycles, and an exponential transient. The voltage remains zero until the breaker begins to open at time t_2. From this time on there is a voltage E across the breaker under test, in phase with the current, since the arc is a resistance phenomenon involving negligible inductance or capacitance, this voltage steadily increasing as the distance between the breaker contacts increase, until finally a cycle is reached where the voltage is insufficient to re-establish the arc, and current flow ceases. This occurs at point t_3; from that point on full line voltage exists across the breaker terminals.

The power expended in the arc at any instant is the product of the voltage and current at that instant, and is always positive, since the current and voltage are in phase; hence it is always of the same sign—that is, both positive at the same time and both negative at the same time. The total energy expended in the breaker during the opening of the circuit is, therefore, represented by the integrated area of the power curve P from time t_2 to time t_3. It is obvious that this has no definite relation to the product of source voltage and current, either normal or short circuit.

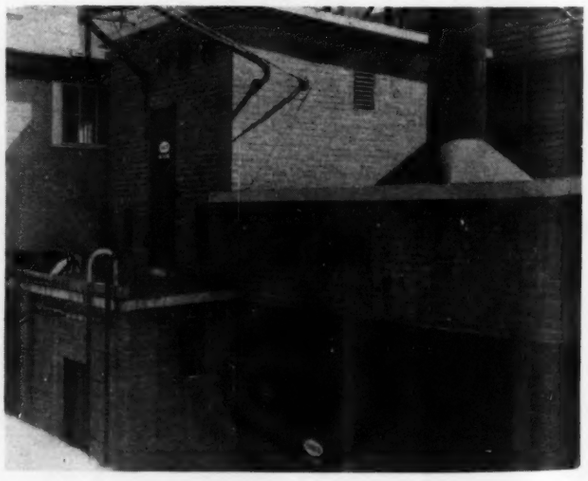
In a similar manner it is possible to obtain and analyze oscillograms of the voltage and current during short-circuit tests on strings of insulators. From such analyses it is possible to obtain the true power values and the total energy or heat expended at the insulators during the short-circuit tests.

All destructive physical effects occurring in the test and operation of electrical apparatus depend upon the total heat liberated at the given point and the rate of applying the power. In discussing the results of such effects we are concerned with the time occupied, the value of the voltage, current, power and total energy.

The explosiveness of the action depends upon the rapidity of power application. The transfer of physical material from one form to another depends upon the value of current and time period, and the extent of physical destruction depends upon the total energy liberated.

Space Limitations Met by Design of Industrial Substation

AN EXAMPLE of industrial substation design in which extremely limited available space was utilized with excellent results for the protection of equipment and property against fire hazards is offered by the Lafayette Mills, Woonsocket, R. I. This plant is served by the Blackstone Valley Gas & Electric Company. In this installation three 500-kva. transformers are housed in the brick compartment shown at the right of the illustration, the normal incoming service being by a 13-kv. messenger-supported aërial cable terminating in a circuit-



ACCESSIBILITY UNIMPAIRED IN TWO-LEVEL INDUSTRIAL SUBSTATION

breaker house as indicated. In case of emergency, temporary service can be supplied over the three-phase open-wire line. In the lower left corner is a switchboard house containing meters and other equipment controlling the low-tension feeders serving the mill. The trans-

former house is ventilated through louvers at the bottom of the building and by the uptake pipe shown in the view. All the substation equipment is accessible despite the handicaps of the location.

Auxiliary Cooling for Transformer Units

Temperature controllers operate apparatus for protection of one or more transformers subject to heavy overloads

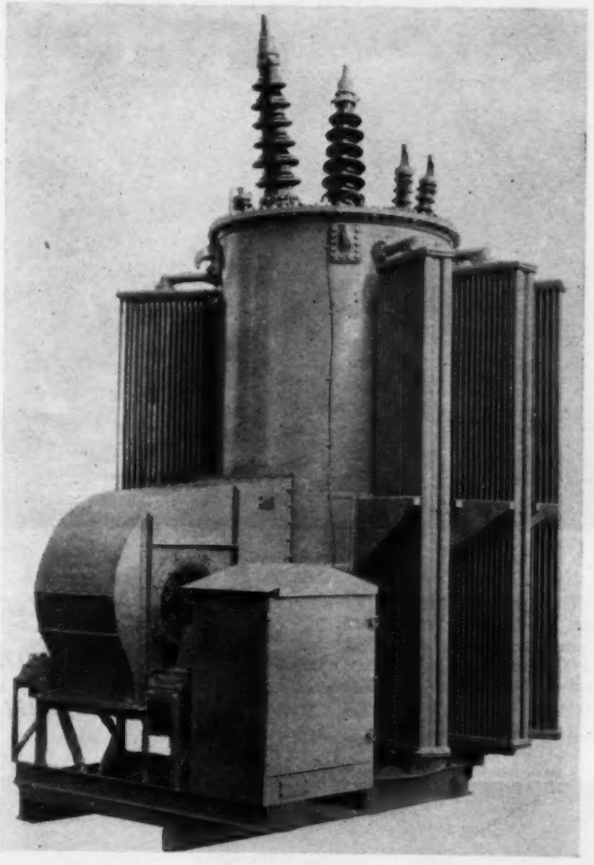
By W. R. Farley
Switchboard Engineer Westinghoue Electric & Manufacturing Company

IT HAS recently become a practice to equip oil-insulated, self-cooled power or distribution transformers with auxiliary equipment such as forced-air cooling or water cooling, as in this way a considerably increased rating can be secured on a given transformer, or more particularly the ability of the transformer to carry heavy overloads in cases of emergency can be raised. This is of considerable value where, for instance, with the outage of one transformer bank for inspection or repairs, the station load can temporarily be carried by the remaining transformer units, if some such method of auxiliary cooling is available. For economic reasons it is usually desirable to resort to such auxiliary cooling only when the load is such that the transformer begins to overheat. Therefore the control equipment is usually arranged to start up automatically the air-blower motors or water-pump motors when the oil in the transformer tank reaches a predetermined temperature and to shut them down automatically when the temperature of the oil again drops to a predetermined temperature.

Where auxiliary air cooling is resorted to, a portion of the transformer case radiators may be surrounded with a sheet-metal housing, through which air is forced under pressure by a blower motor. The illustration shows a 10,000-kva., 76,200/58,000/13,200-volt single-phase transformer complete with a 10-hp., 220-volt, three-phase blower motor, blower and housing for motor and control equipment. The blower motor is suitable for full-voltage starting and is connected to the incoming power by a magnetic across-the-line starter. Inverse-time-limit-overload protection on the motor is obtained by means of a thermal relay with two heating elements, one connected in each of two phases. Short-circuit protection for the motor is provided by fuses on the supply line.

The control connections are so arranged as to impose a very light duty on the relatively fragile and slow-moving thermometer controller contacts, which have approximately a 15-watt rating. For example, when using two auxiliary relays with the transformer but slightly loaded and the oil cool, the thermometer contact short circuits the coil of one auxiliary relay and energizes the coil of the other, closing contact. If now the transformer oil temperature is increased to a predetermined point, the contact of the thermometer relay will be broken, but the auxiliary relay will not operate until the "hot" contact of the thermometer is made; this will short circuit the "cold" contact of one auxiliary relay, which in opening will have its operating current broken on its "cold" contact. The closing of the thermometer contact causes the coil of the other auxiliary relay to be energized, and after closing, the latter will have a holding circuit through its "hot" contact. The magnetic across-the-line starter is energized by this action and the motor connected to the line. It is thus seen that the duty on the thermometer contacts is nominal, as no coil circuit is opened; no current is carried continuously and no deterioration will therefore result, even after hundreds of operations.

Where more than one unit is used, a separate thermometer is provided for each one. Alarm contacts, set to close at a higher temperature than the temperature controller used on the blower motor control, furnish an alarm if for any reason the transformer temperature should become dangerously high.



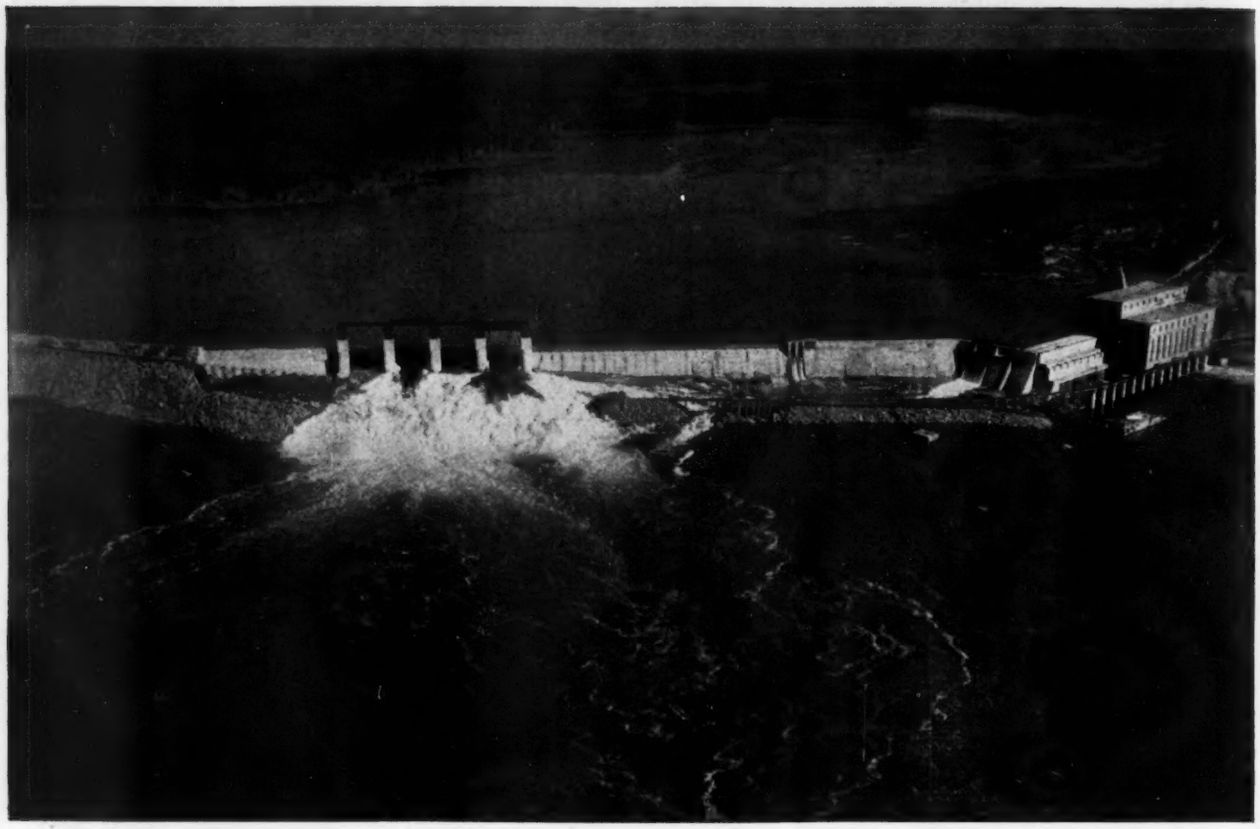
BLOWER UNIT FOR AUXILIARY AIR COOLING OF 10,000-KVA. TRANSFORMER

The control equipment includes a three-pole non-reversing magnetic across-the-line type starter, with a thermal overload relay, an auxiliary relay, comprising two two-pole alternating-current contactors mechanically interlocked and mounted in a common case, and a temperature controller involving two contacts, each adjustable between, say, 40 to 110 deg. C., and the thermometer bulb for immersion in the transformer oil.

Control may be so arranged that when the "hot" thermometer contact of one or more transformer units closes, both of the two-pole contactors of the auxiliary relay close, causing the magnetic across-the-line starter to function and the motor is connected to the line.

Suitable modifications in the control equipment will allow the use of direct-current control and alternating-current motors, or direct-current control and motors can be used, although in general the alternating-current motor and control will be found to be simpler.

The combination of the thermometer contacts with the auxiliary relay will be found to be generally applicable to all control schemes where the contacts of the main controlling relay or device are relatively light and slow moving.



The Great Falls power station of the Manitoba Power Company, shown above, has 84,000 hp. installed capacity and utilizes a head of 56 ft., serving Greater Winnipeg.

Two Important Developments on the Winnipeg River

Another plant near the city of Winnipeg, the Pinawa channel station of the Winnipeg Electric Company, shown below, has 37,800 hp. installed with a head of 40 ft.

Manitoba Water Powers

Reviewed by Dominion Reclamation Service

More than 3,000,000 continuous horsepower available at minimum flow. Present development 225,800 hp. Nelson River has great possibilities

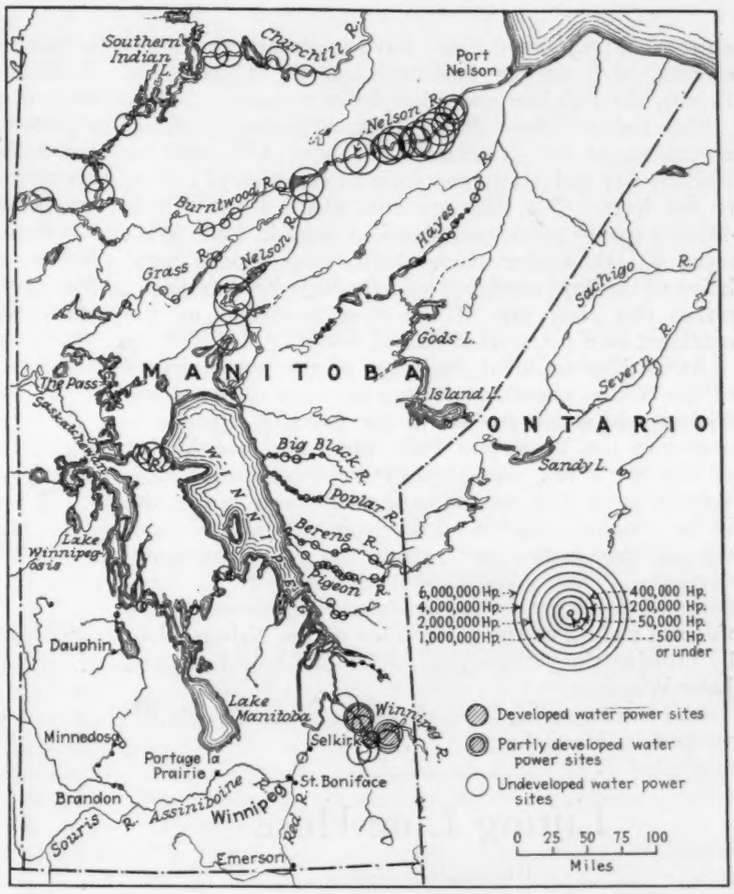
THE water powers of Manitoba, Canada, are already playing an important part in the industrial life of the province. An excellent outline of the power possibilities of this progressive western province is contained in a review just issued by the Dominion Water Power and Reclamation Service, chiefly based upon surveys and investigations carried out during the past fifteen years by officers of the service. These investigations have involved the establishment of a comprehensive scheme for the complete development of the Winnipeg River, a similar scheme for the Saskatchewan River at Grand Rapids and the Nelson River at Whitemud Falls, while detailed studies have been made of the power possibilities of such rivers as the Wanipigow, Manigotagan, Bloodvein, Berens, Pigeon, Daupin and others.

There is available on the various rivers of the province a total of more than 3,000,000 continuous horsepower under conditions of ordinary minimum flow, and more than 5,000,000 continuous horsepower at ordinary six-month flow. At sites already developed there is at present a total turbine installation of 225,800 hp., with provision to increase these plants to an ultimate capacity of 310,000 hp.

The most important of the power rivers of the province, from the standpoint of present utility, is the Winnipeg River, which supplies the greater part of the power at present being used in the province. Existing power plants on this river are already supplying about 200,000 hp. for the needs of the industrial center of Greater Winnipeg, and the increasing demand for power in that part of Manitoba will call for the development of the remaining sites on the river within a comparatively short period.

Although the greater part of the drainage basin of the Winnipeg River lies outside of the province, the most important power reach of the river is in Manitoba. Complete topographic surveys have been made and the hydrometric data obtained for the reach, and the information secured has been used to make a comprehensive scheme for the most efficient utilization of the power resources. This scheme provides for the development of the available power at nine sites, seven of which are on the main river above Seven Sisters Falls to Lac du Bonnet. Three sites are already developed, two on the main river and one on the Pinawa Channel.

Surpassing the Winnipeg in available power but at present unutilized owing to lack of a market are the Nelson and Churchill Rivers, the power of which taken together includes three-quarters of the total power re-



LOCATION AND MAGNITUDE OF DEVELOPED AND POTENTIAL WATER POWERS IN MANITOBA

HYDRAULIC INSTALLATIONS IN MANITOBA, 1926

Company or Owner	River	Location of Plant	Head in Feet	Installed Horsepower
Canada Gas & Electric Corp.	Minnedosa	Near Brandon	33	1,000
Manitoba Power Comm's'n*.	Minnedosa	Minnedosa	22	125
City of Winnipeg	Winnipeg	Point-du-Bois	46	102,900
Winnipeg Electric Company.	Winnipeg	Pinawa channel	40	37,800
Manitoba Power Company..	Winnipeg	Great Falls	56	84,000
Total				225,825

* Manitoba Power Commission purchases a block of power from the city of Winnipeg.

WHITEMUD FALLS ON NELSON RIVER, WHERE IT IS ESTIMATED 180,000 HP. CAN BE DEVELOPED AT MINIMUM FLOW AND 290,880 HP. UNDER ORDINARY SIX MONTHS' FLOW

sources. Many other rivers have important power resources, such as the Saskatchewan, the Pigeon, the Berens, the Fairford and other lesser streams.

The Nelson River drains Lake Winnipeg, running northwesterly for a distance of about 430 miles to Hudson Bay and descending from an elevation of 710 ft. to sea level. The drainage area above its mouth is 450,000 square miles, and above its head in Lake Winnipeg 403,000 square miles. Remarkable natural regulation of the flow, combined with the large head available, makes this river one of the most important on the continent as a potential source of power.

As an illustration of the value of the water powers of the Nelson River and their importance to the industrial growth and expansion of the province attention is drawn to the Whitemud Falls site. An investigation of this site a few years ago by the department's engineers showed it to be the most outstanding power site in the province, capable of developing 180,000 continuous 24-hour horsepower which can be economically developed. The investigation also showed the feasibility of considerably increasing the power output of this site and all of the power sites on the Nelson River by utilizing the storage possibilities of Cross Lake and Lake Winnipeg.

The accompanying table shows the power already developed in Manitoba.

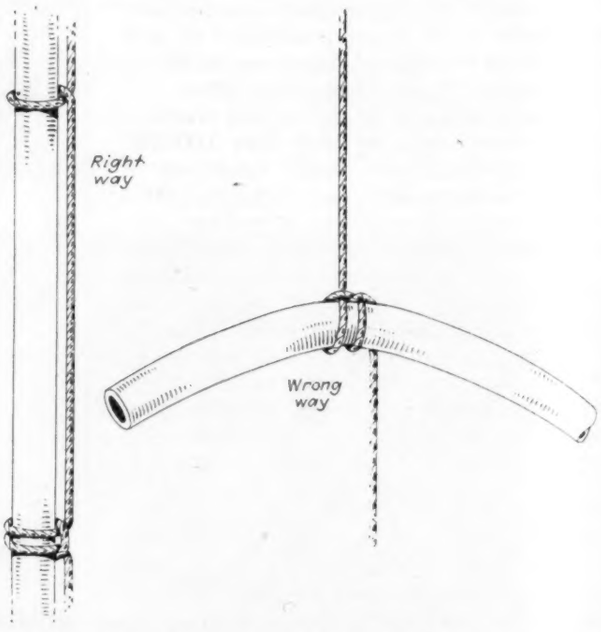
Lifting Line Hose

By Cecil Rhodes
Madison Gas & Electric Company, Madison, Wis.

WHEN a lineman on a pole drops his hand line to the ground below to bring up a length of protective hose, it is quite common practice for the groundman to tie the line with a single hitch around the hose at the middle. When the lineman hauls it up, the hose very often gets crosswise to the wires in the lead below the arm on which the lineman is working and it is sometimes bent very sharply in the middle as it is pulled through the 14-in. spacing of the lower wires. This bending of the hose has a bad effect on it and in time cracks will develop at the point of bending. Not only is the hose deteriorated and made unsafe at the bend but also such treatment materially reduces the life of the hose and new pieces must be substituted for ones having only a single bad spot in the middle.

In order to correct this condition there has been incorporated into the safety practices of the Madison Gas & Electric Company the definite instructions that the users of protective rubber equipment must see that when a piece of line hose is raised it shall be tied in the hand line with a hitch at both ends so that it may be pulled up vertically through the lower wires of the lead without bending.

Protective rubber covering is also lowered by a hand line in a similar manner and it is not thrown from the pole to the ground, in which case it might become damaged. It must be remembered that these rubber goods are to save and protect life and should not be abused.



RIGHT AND WRONG METHODS OF TYING HAND LINE TO RUBBER HOSE

This order affecting rubber protectors is only one of the many definite requirements for the safety of linemen and other workers that have been brought out by direct suggestion of the men themselves in the monthly joint safety meetings of the operating departments of the Madison Gas & Electric Company. As instancing the very live interest taken by all those in attendance at these meetings, there is the record of one meeting at which eighteen men made 32 suggestions pointing toward safer operating conditions.

Carrier-Current Protection
for Transmission Lines*

High-frequency system offers modified differential control of power lines. Overload relays trip breakers on line faults. Apparatus meets test conditions of service approximation

By A. S. FITZGERALD
Radio Engineering Department, General Electric Company

THE increasing complexity of modern transmission networks presents many difficult problems in connection with the design and application of protective relays. On the larger systems the use of increased time delay may be inadmissible on account of the difficulties met with in maintaining stable operation. There is, on the contrary, a tendency toward a reduction in the time of operation of relays.

There is a growing interest in differential methods of protection—that is, in systems in which comparison is made between currents which under normal conditions are necessarily equivalent. These have the advantage of not being dependent upon the performance of relays in other circuits for their selective action.

The term carrier current is employed as descriptive of alternating-current energy generated at frequencies which lie, roughly, between 10 and 200 kilocycles. At these frequencies the transmission of electrical energy exhibits special characteristics due to which it is possible to superpose carrier-current-control circuits on transmission lines or cables.

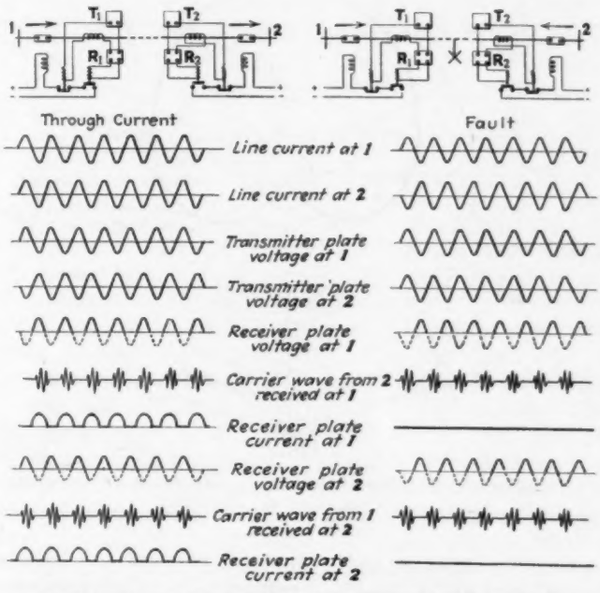
A transmission line may be equipped with a circuit breaker at each end and with relays designed to trip the breakers automatically in the event of abnormal currents being carried by the line. The relays may operate on overcurrent or on ground current, or may be power-directional. Such relays will correctly indicate abnormal conditions, but in the general case do not, by themselves, distinguish between a fault on the line, when we want both switches to trip, and a fault elsewhere, when we wish to avoid interrupting the line.

In order to accomplish this we must know at each end of the line what is happening at the other end, and it is for this purpose that we employ the carrier-current system.

PRINCIPLE OF OPERATION

The effect of a fault on the normal direction is the feature employed to discriminate. In order, however, to avoid potential excitation, the direction of power is not used, but instead, the instantaneous direction of current. This is done in the following way:

The carrier is not used to trip the circuit breakers when the line itself suffers a fault. If this were done, we could not be sure of proper operation if the line should be connected to a source at one end only, or if the line should break in such a way as to bring about this condition. Moreover, the carrier channel may be interrupted by the fault.



OPERATING PRINCIPLE OF CARRIER-CURRENT PILOT SYSTEM

Current and voltage wave forms under conditions of normal operation and fault are indicated. T_1 and T_2 are transmitting devices at either end of line. R_1 and R_2 constitute receiving equipment at the respective terminals.

Thus, at each end, overcurrent relays are installed and connected to the oil-switch trip circuit. If the instantaneous currents at each end of the line have the same direction, indicating that the line itself is sound, a carrier signal is received, preventing the overcurrent relays from tripping the circuit breakers. This looks after the stub feed, or broken line condition.

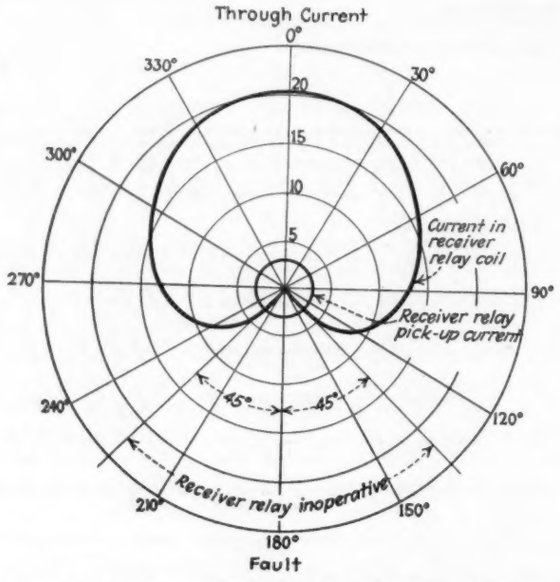
If a three-electrode tube oscillator be operated from an alternating-current plate voltage, it will oscillate intermittently during those half cycles only when the plate is positive.

In a similar way a bias detector may be supplied with an alternating-current plate voltage. It will be inoperative during the half cycles when the plate is negative, but during the positive half cycles, if the grid potential permits, plate current may flow. The grid will be excited from a source of 180 deg. out of phase with the plate voltage, so that normally there will be no plate current, the grid being negative when the plate is positive. If

*Excerpts from paper presented at the Pacific Coast convention of the American Institute of Electrical Engineers.

there be impressed on the grid an additional voltage of carrier frequency, a rectified current may be caused to flow in the plate circuit, but this can occur only during a positive half cycle. Thus we may have a transmitter sending during alternate half cycles and a receiver capable of receiving only during the intervening half cycles. A relay may be placed in the plate circuit of the receiver tube; this will operate when carrier is received.

One of the accompanying figures shows, in an elementary manner, how these features may be arranged to furnish the desired result. The diagram represents a transmission line having a circuit breaker and overcurrent relay at each end. The two ends of the line are designated as "1" and "2" respectively. Carrier-current transmitters T_1 and T_2, at each end, together with receivers R_1 and R_2, are excited from current transformer secondaries. When carrier is received, the receiver relays open the trip circuits and prevent the opening of breakers. The equipment at each end is the same except that, as shown, one of the current transformer secondaries is reversed.



POLAR DIAGRAM SHOWS EFFECT OF PHASE RELATION BETWEEN RECEIVER AND TRANSMITTER

The left-hand series of diagrams refers to the case of a sound line which may be supposed to be carrying excess current to a point beyond the bus. It will be seen from the diagram that the primary currents are identical, whereas the plate voltages of the transmitters, which are derived from the current transformer secondaries, are of opposite polarity. The receiver-plate voltages at each end are reversed in respect of the adjacent transmitters. Thus the receiver voltages are also 180 deg. displaced from each other. Each receiver, therefore, is inoperative during the half cycle occupied by the transmission from the transmitter at the same end, and cannot receive from the latter.

Referring now to the transmitter-plate voltages at opposite ends, as shown in the left-hand diagram, it can be seen that the positive half cycles occur alternately. Thus the two transmitters, oscillating intermittently, send out pulses of carrier in alternate sequence. The positive half cycles of the receiver-plate voltage are shown in full lines and the negative half cycles, when the receivers are inoperative, are shown in broken lines.

Therefore R_1 is inoperative while T_1 is sending, but can receive from T_2. Likewise R_2 can receive from T_1 but not from T_2. In the case illustrated by the left-hand series of diagrams, both receivers are operated and the receiver relays open the trip circuit and thus prevent the overcurrent relays from tripping the circuit breakers.

The right-hand series of curves shows the conditions when there is a short circuit on the line. In this case both the transmitters are sending simultaneously, during which period neither of the receivers is able to receive. When both the receivers are operative, neither of the transmitters is sending. Thus the receiver relays are not opened and the line is tripped by the overcurrent relays at each end. The operation of the system, therefore, is such that if a current enters at one end, that end will be opened automatically unless the current is "registered out" at the other end, which is an indication that the line is sound. If a fault be fed from one end only, the transmitter at the other end will not be excited by the current transformer and will not transmit. The fault will therefore be cleared, at the end from which it is supplied, by the overcurrent relay.

A unique feature of this arrangement is the fact that it is possible to send and receive in both directions at the same time and at the same carrier-current frequency. Thus only a single frequency is required instead of two. This is a distinct advantage if a number of lines is to be protected by this method, and is one which will become more evident as the use of carrier current for purposes of communication and control becomes more prevalent.

Phase Relations

In the explanation of the operating principles of this system it was assumed that when the line is sound the two currents will be in phase and that when the line suffers a fault the instantaneous currents will be of opposite polarity. In the development of this system it has been necessary to consider to what extent this is actually correct under service conditions.

In the case of a "through" short-circuit current, the currents at each end of the line are in actual fact identical on lines of present length, except for the charging current of the line, which in most cases is small in comparison with the current at which the overcurrent relays would be expected to operate.

When the line itself suffers a fault, the two currents are not identical. They will usually be of different magnitude, but will in general be very nearly 180 deg. apart in phase relations. There may be special cases, however, where the fault is fed from each end through circuits having different impedance power factors, which may result in some slight departure from this phase relation, and this possibility has been studied. A polar curve which shows the effect on the current in the receiver relay of variation in the phase relation between the primary currents exciting the transmitter and receiver is illustrated. It is evident that in the case of a "through" short-circuit current there is no risk of the receiver relay failing to pick up, as the currents are identical. In the case of a short-circuit on the line, the relay should not pick up. It can be seen that there must be a difference of at least 45 deg. between the two currents before this can occur.

In order to apply this arrangement to the protection

of a three-phase line, it is not necessary to use three carrier-current equipments. All that is required is to furnish an arrangement of primary windings such that any possible fault condition will energize the plate transformer.

It will be necessary to bring the carrier apparatus into action on the occurrence of the following currents. We may refer to the three phases as A, B and C.

Three-phase fault on	A B C	Ground fault	A
Fault between lines	A B	Ground fault	B
Fault between lines	B C	Ground fault	C
Fault between lines	A C		

The minimum number of exciting windings which will enable each of these conditions to furnish energy is three. By providing, therefore, three windings, of dissimilar numbers of turns, each of the above cases will set up a resultant excitation of the transformer. The magnitude of this resultant will necessarily vary according to which of the above conditions holds. Since, due to the glow tube, the carrier-current system operates over an exceptional current range, this variation will be of no moment, provided that the minimum excitation—that is, when the least effective combination of turns results—is sufficient.

It is very often an advantage to be able to furnish more sensitive operation in the case of ground faults than where the trouble arises from a short between lines. Moreover, a ground fault, limited in magnitude perhaps by an earthing resistance or maybe by the high reactance or resistance of the abnormal return path, may not cause complete reversal of the current if an appreciable load is present.

Thus it may be desirable so to arrange the means whereby the flow of current controls the carrier apparatus that a ground fault has a preponderating influence. We may do this by furnishing two windings of equal turns connected directly in the current transformer secondary circuit and one of an increased number of turns connected in the neutral circuit of the three-current transformers.

Three tripping relays and three filament relays are employed. In each case one may conveniently be a ground relay which may be set to operate at a lower value of overload than the others.

This system will furnish protection substantially equivalent to that which may be obtained with a pilot wire system, provided that the lowest phase-fault current at which it is desired to operate is not less than the normal rated current of the line. In the case of ground faults, it is possible to obtain operation at lower values than full load current.

In cases where it is required to take care of phase-fault, short-circuit currents, which are less than full load, it is desirable to install additional filament relays to avoid continuous operation of the tubes during normal load conditions.

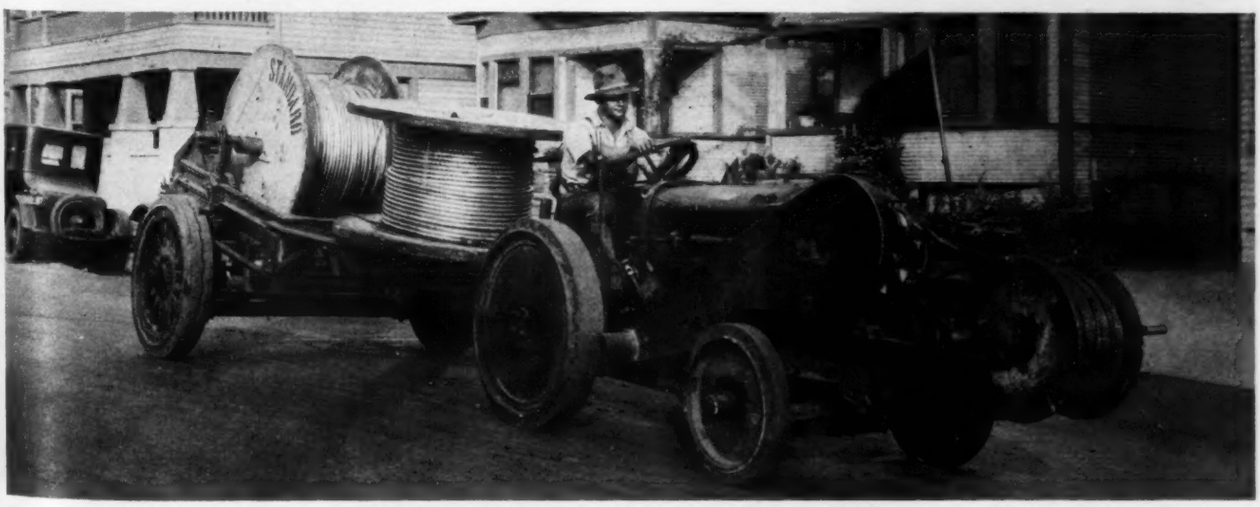
The apparatus may be operated from bushing transformers as well as from standard types of current transformers.

Tests have been made on a 66-kv. line about 30 miles in length. The apparatus was excited from standard bushing transformers. Actual short circuits, both between phases and to ground, were applied to the line itself or at neighboring locations. The system performed satisfactorily with fault currents which ranged from 200 to 1,700 amp.

Underground Cables Pulled with Special Tractor

TWO specially designed tractors are used by the Los Angeles Gas & Electric Corporation for pulling underground cables and service laterals. One of these, shown in the accompanying illustration, is a 2½-ton Fordson tractor specially designed to meet the specifications of the power company. It is equipped with a winch on the front, with a draw-bar pull of 5,000 lb.; it will pull cable at a speed of 40 ft. per minute. The traveling speed on the street with loaded reel dolly is about 15 miles per hour. The cable dolly is a Utility Corporation product, made to carry a reel of cable not to exceed 80 in. in diameter and 50 in. in width and weighing 5 tons. When the equipment arrives on the job, the reel dolly is placed for feeding the cable into the manhole and the tractor disconnected and set up at the next manhole for pulling.

The company also uses a 20-hp. McCormick-Deering tractor similarly equipped with a cable-pulling winch in front of the tractor. It travels about 10 miles per hour, has a draw-bar pull of more than 5 tons on the winch and will pull cable at the rate of 40 ft. per minute.



TRACTOR WITH CABLE-PULLING WINCH AND REEL DOLLY

An Electric Home on Wheels for Appliance Demonstrations

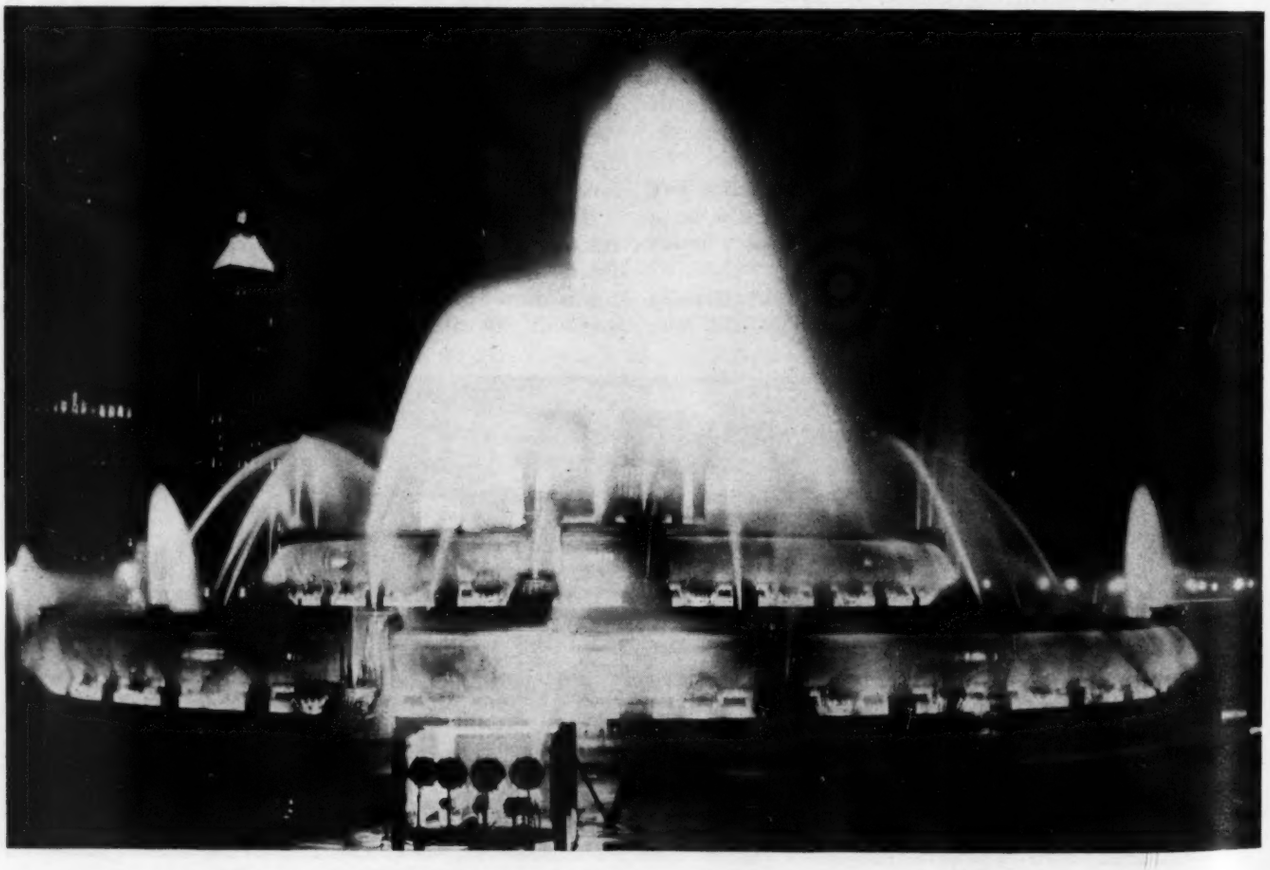
PORTABLE ELECTRIC HOUSE HAS ABOUT 40 OUTLETS: 110 AND 220-VOLT SERVICES ARE USED FOR MISCELLANEOUS APPLIANCES AND RANGE WORK

TO DEMONSTRATE the value of electrical household conveniences a model two-room home on wheels has been constructed for the Tampa (Fla.) Electric Company under the supervision of Richard Harte, of Stone & Webster, Inc., who is also president of the Florida Motor Lines, Inc. The house is 32 ft. long by 90 in. wide over all and is divided into kitchen and living room sections wired to demonstrate most of the leading appliances available for the modern electrified home. Two storage batteries are provided to operate various appliances when the usual connections cannot readily be made with the company's distribution lines; but it is planned to park the outfit near such lines whenever feasible and to give time for thorough examination of the devices installed. An extensive line of devices for living rooms, boudoirs, kitchens and other quarters is shown, including range, dishwasher, portable heaters and lamps, a six-tube radio set, domestic power-driven apparatus, etc.

Pumping and Light Load Valuable in Illuminated Fountains

THE Buckingham Memorial Fountain, located on the lake front in Grant Park, Chicago, Ill., is considered one of the world's most beautiful. It is operated with power from the system of the Commonwealth Edison Company. There are a total of 133 rotating and fixed jets supplied by three pumps with maximum capacity of 14,000 g.p.m. The pumps are driven by three motors of 300, 190 and 90 hp. The first motor is used only when the fountain is in major display, usual operation requiring the second two only. The total connected motor load is 350 kw.; 83 kw. is used in cone and floodlighting, which by means of dimmers and control connections suffuses the rising and falling waters with a constantly changing play of variegated colors. The total cost of the fountain was $750,000, including equipment.

The lighting equipment consists of 84 special 500-watt cast-aluminum watertight floodlighting units and 594 watertight 75-watt fixtures, both furnished by the Crouse-Hinds Company. The electrical contractor was the Oscar M. George Company, Chicago. Bennett, Parson & Frost were the architects.



ILLUMINATED FOUNTAINS SUCH AS THIS AFFORD ATTRACTIVE LIGHTING AND PUMPING LOADS

Broadcasting Over Wires

Great strides have been made in the development of this form of entertainment. Can be made highly profitable to utilities if they will recognize its possibilities

Interview by Wingrove Bathon with

Major-Gen. GEORGE O. SQUIER, U. S. A. Retired

Former Chief Signal Officer

ON APRIL 22, 1922, an editorial appeared in the ELECTRICAL WORLD entitled "Broadcasting Over the Wires," which, in the opinion of General Squier, "very accurately expresses the radio situation as it exists today." He has asked that the editorial be reproduced, saying, "Although written five years ago (and much water has gone over the dam since then), it is to my mind remarkable that such an accurate forecast was made at that early date of the most important and hitherto baffling subject of broadcasting."

MAJOR-GEN. GEORGE O. SQUIER

In the interview which followed this request General Squier recalled that it was on March 24, 1922, that he proposed the use of the ordinary electric lighting distribution network for the purpose of distributing so-called radio programs to the urban population. At that time he proposed that a careful investigation and study of this subject should be made by the authorities in charge of the electric lighting and power companies.

"At first I was in grave doubt that the plan would work at all in practice," declared the General, "due to the great mass of lamps in parallel across these wires, which would serve to short circuit the high-frequency energy. I also feared that suitable high frequency would be choked or stopped by the ordinary iron-cored transformers that are used throughout the lighting system, substations, etc.

"I sought answers to these basic questions from the authorities at the Bureau of Standards, and no one could be found who could make any prediction as to what would happen in regard to these two fundamental objections.

"Experiments were, therefore, necessary to check up on these two points, and these were conducted by the engineers of the Signal Corps of the United States Army. They were extremely simple experiments and were conducted in Washington and over the lines of the Commonwealth Edison System in Chicago, where the Signal Corps had a small transmitter in army headquarters designed for military purposes. These experiments showed that programs sent out from army headquarters in Chicago were readily received in different parts of Chicago without altering in any way the electric lighting system, and, indeed, without the knowledge of the Commonwealth Edison Company.

"This showed that the ordinary power transformers distributed throughout the electric lighting system will transmit high-frequency energy without the necessity of any bypass condensers, due to the electrostatic capacity of the two sets of wires themselves."

General Squier pointed out that he expected electric light and power companies everywhere to begin experimentation on this important subject. "But," he reminded, "very little has been done; and it should be done now by the electric light and power companies. There was one company—namely, the North American Company—which proceeded immediately to investigate this subject and which has continued to do so to the present day, in spite of all sorts of difficulties and obstacles to overcome. The officials of this company deserve great credit, in my judgment, for their persistence, foresight and ability in the face of great obstacles. Certain great companies, however, instead of assisting the North American Company, interfered, I am informed, to handicap them. But now, I understand, some of these great companies have seen the light, and I am told that there is a prospect of some co-operation.

"Electric light and power companies have been in the broadcasting business from the beginning. There is nothing new about it to them. It is true they have been broadcasting principally for the eye instead of for the ear. In addition to lighting, the power companies have also been 'broadcasting' a vast number of conveniences into the home, such as flat-irons, curling irons, fans, etc. The superb network of wires used for broadcasting power and light has been the result of some 40 years of splendid effort."

WIRE BROADCASTING

Up to the present time broadcasting in this country has been based on the principle that the program should be given free to the listeners. Some other nations have

charged for this. "One of the great advantages of broadcasting over the lighting wires," declares General Squier, "is a psychological one. As long as a man buys a radio receiving set, brings it to his house, puts it on a table and turns some knobs himself to get a program, he thinks he has, in a sense, earned his program.

"But the moment this receiving set is plugged into the ordinary lamp socket or service outlet the psychology of the situation is changed. He has never yet received anything over the socket free and never expects to, because some company had to build the plant, secure franchise for it, maintain it and sell him valuable things either in light, heat, cooled air or refrigeration, etc., which came from it.

Broadcasting Over the Wires!

GREAT interest has been created by the recent announcement from General Squier of a new device to broadcast entertainment over the electric light wires. Electrical men are eagerly discussing it. To the public it comes as a new manifestation of the wonders which the future seems to promise in the field of communication. It suggests a startling innovation in the service of the central station and possibly, also, of the telephone company.

Naturally our minds turn first to the technical aspects of the situation. But, looking beyond all the debatable engineering obstacles and possibilities, there is one fundamental fact that we must keep prominently in mind.

THE world has gone wild over wireless. True. But when you come to analyze it, it is not radio that so interests everybody, but broadcasting. Wireless telegraphy and wireless telephony, through the years of their development, have ever appealed to the popular imagination as scientific marvels. But this meant nothing to the ordinary life until the idea of broadcasting was conceived. Radio was a science. Broadcasting is human. It is something to play with, something to enjoy, and it has swept the country in a wave of growing popularity

So the people want broadcasting and they are getting it. Everybody has been wondering how the ether is to be policed with all these concert, lecture and news programs floating through space, to say nothing of the deluge of wireless political eloquence that is beginning to radiate from Washington Nobody knows just how all this free entertainment and advice is to be paid for. But nevertheless the demand for more is clamorous, and radio receiving sets cannot be manufactured fast enough to fill the orders that pour in from town and country.

Now comes the next step—wired wireless—and the recognition that the power and telephone lines themselves will distribute entertainment broadcast. And, realizing that after all it is not radio that the people want but merely broadcasting, this thought logically follows: Why not enter this new field with a new service over the existing wire systems and develop broadcasting as an additional source of profit for the public utility?

HERE are our great existing utility systems—already capitalized, already organized, already in physical contact with millions of homes. If these households want broadcasting, why not make this a great appealing service from the public utility, winning friends for every central station? Let this entertainment travel to connected homes along the wires, and to the rest by wireless. There is market enough for all. And the bigness of the opportunity will pay the cost of all the engineering effort needed to prepare the way

REPRODUCTION OF EDITORIAL IN "ELECTRICAL WORLD" OF APRIL 22, 1922

"There will never be any trouble or complaint from the public in collecting revenue from broadcasting of a high standard which is delivered by wire to the home. This has already been proved in some of the Western States.

"From this it will readily be seen by the thoughtful electric light and power executive how many millions of dollars in revenue have been lost to the light and power companies so far. That loss should be halted and revenue should begin.

Opportunity to Radioize the Home

"Furthermore, just as every room of an American home is now lighted from cellar to garret to please the eye, so the electric light people, when and if they enter this field, as they should, will ultimately radio every room in the house. The architect and builder of tomorrow will include a complete radio plan for the home in his original plans. In other words, instead of one radio in the home, we are headed for the 'radioized home,'" prophesies the General. "The home will be furnished for the ear for the first time—a sort of oral furniture—which will make every chair in every room of the house, wherever it is, become a seat in a super-theater, a church or a university. There will even be provision in the bedroom for little pillows upon which one may lay one's head at night and go to sleep listening to a soft speaker instead of a loud speaker."

Two vast wire networks, the telephone wires and the electric lighting wires, are already side by side in millions of American homes. Either one of these wire networks may be used for program distribution, in co-operation or competition. At the present moment the electric wire network is rapidly simplifying all of the complicated apparatus that we had two or three years ago. A, B and C batteries are now disappearing and even the vacuum tubes themselves are operated by raw alternating-current direct from the service outlet. The whole apparatus is becoming robust and virile and should be thought of as power-operated rather than otherwise.

"The transmission of the high-frequency waves over wires presents many difficulties, as was foreseen in the beginning," explains the former chief signal officer. "The large number of electric appliances now operating on a lighting line, such as fans, elevators, dental machines, X-ray machinery, medical apparatus, etc., produces a number of surges and irregularities in the power circuit itself. These are generally classified as man-made static, but they are easily removed, and the power companies themselves should do this and clean up their lines, which is a simple thing to do.

"On the other hand, the other system of wires in the American home—namely, the telephone—is a perfectly clean circuit buried under ground in standard cables or suspended from pole lines in such cables. The disadvantage here is that there is no electric energy on it to operate radio receiving sets, so that we find that the power lines, on the one hand, carry their own power for the operation of the set and have a more difficult channel for the high frequency. The telephone lines have a far superior high-frequency channel, but are forced to go to the power lines for operating their sets. The power people can do it alone, but the telephone people are dependent upon the power people.

"A third method would be to lay a third set of wires, which would require years of time and untold millions of money. This is inconceivable on a national basis and economically ridiculous.

Need Improved Reception for Urban Home

"There are two kinds of radio, instead of one. The present radio receiving set is admirably adapted to its purpose in isolated districts, such as rural communities, far from the cities. This same set when brought to the congested city, however, performs in an entirely different manner. The reason for this, of course, is modern steel construction, electric railways, etc. This is believed to be the only instance where service is worse for a city than it is for the country.

"The truth is, the solution of the urban radio has not arrived. Elaborate measurements by the engineers of the American Telephone & Telegraph Company have conclusively shown the complicated and remarkable variations of radio signal strength in the city of New York. It is shown, for instance, that by the mere moving of a receiver up to a window, instead of in the center of the room, the strength increases six to one. The public does not know this, although it is common knowledge that sets do not work as well in the cities as they do in the country.

FIRST DEMONSTRATION OF "WIRED RADIO" OVER ELECTRIC LIGHT WIRES ON MARCH 24, 1922

"If radio programs, however, were delivered over either the electric power line or the telephone line, radio would be lifted to an entirely new plane of performance. There would be no static, no day and night effects, no seasonal changes, no more fading, and then radio, to the city dweller, would be superior instead of inferior to the set of the isolated farmer, who puts an antenna on the barn and uses dry batteries, etc. In other words, the city radio set has not yet appeared. It will be very much simpler than the present set and will be operated by pressing a button in the same manner as we use in turning on the light.

"We want to pay more for things in the cities. We are used to paying for things in the cities. The man who loves DX in the country does not care for such a thing in the city. For instance, when this man comes back to town he is busy, has an active life. He has no time during the day to think of radio programs particularly or to read in the newspapers the long list of things that are going on throughout the United States which might be received by radio. He comes home in the evening and wishes to turn on his radio in the simplest manner, without being obliged to work, and he expects to be furnished, as a newspaper furnishes him, with important national events mixed with local events and advertising in the proper proportions.

"Broadcasting in cities now is already practically conducted by wire. In my own hotel, for instance, the radio receiving set is in a special room for the guests in the lobbies. It is invariably tuned for W R C, which is perhaps a mile from my hotel. It is linked up with the 'red network' throughout the country. The programs are excellent, far better than any individual could make up himself, so that everyone accepts this program as his radio entertainment for the day. As a matter of fact, when Mr. Hoover speaks from Memphis, or President Coolidge from Pittsburgh, instead of being radio, as it is called, as far as my hotel is concerned it is almost all a wire proposition and only about one mile of it is radio. It is this one mile of radio that introduces all the trouble to the program. If I could move my set down to the W R C station and connect it directly to the wire, there would be no fading, no static, no day and night effects and no seasonal changes.

Consumption of Industrial Customers

How the energy generated and purchased by the Alabama Power Company is divided up by industrial users

DURING the period from Jan. 1, 1926, to Dec. 31, 1926, the Alabama Power Company generated and purchased a total of 1,421,310,000 kw.-hr. Of this amount wholesale customers used 1,121,930,000 kw.-hr., the remainder being retail operations, used by company and all losses. Of the wholesale energy 608,600,000 kw.-hr. went to the various industries served directly by the Alabama Power Company and 513,630,000 kw.-hr. was sold to other public utilities such as the Birmingham Electric Company, the Georgia Power Company, the Mississippi Power Company, etc.

The division of the 608,600,000 kw.-hr. consumed by industry is given in the accompanying table. This table also gives data on the number of customers, average monthly consumption and the average monthly maximum demand per customer for both the twelve-month

DIVISION OF POWER AND ENERGY AMONG INDUSTRIAL CUSTOMERS SERVED BY THE ALABAMA POWER COMPANY

Industry	Average Number of Customers		Total Consumption All Customers		Connected Load as of Dec. 31, 1926, Hp.	Average Monthly Consumption per Customer		Average Monthly Maximum Demand per Customer*	
	Twelve-Month Period	Eighteen-Month Period	Twelve-Month Period, Kw.-Hr.	Eighteen-Month Period, Kw.-Hr.		Twelve-Month Period, Kw.-Hr.	Eighteen-Month Period, Kw.-Hr.	Twelve-Month Period, Kw.-Hr.	Eighteen-Month Period, Kw.-Hr.
Brick plants	11.3	11.5	6,489,000	9,926,000	4,190	47,700	47,700	191	196
Cement plants	3.0	3.0	55,258,000	83,817,000	15,200	1,535,000	1,550,000	3,160	3,260
Coal mines	73.7	74.8	73,018,000	114,324,000	60,075	82,500	85,000	278	288
Cotton gin and compressors†	81.0	60.0	3,970,000	4,049,000	9,165	8,200	7,480	57	58
Cotton mills	50.2	50.8	142,337,000	223,798,000	67,440	236,000	244,000	788	802
Cotton oil and fertilizer	16.1	16.2	10,869,000	16,433,000	7,190	56,300	49,500	185	189
Electrochemical	1.0	1.0	109,408,000	176,144,000	30,000	9,120,000	9,780,000	12,200	14,300
Foundries and machine shops	21.8	22.4	6,400,000	10,332,000	7,180	24,500	25,600	138	147
Graphite plants	1.7	1.8	487,000	852,000	450	24,370	26,600	109	117
Ice plants	17.7	18.0	12,879,000	19,125,000	5,585	60,700	57,100	147	142
Ore mines	11.5	11.7	14,517,000	20,568,000	15,430	105,000	97,800	592	577
Public utilities	17.1	16.4	513,630,000	847,870,000	§236,250	2,500,000	2,870,000	6,850	7,730
Quarries	16.3	18.0	11,767,000	16,830,000	10,205	60,000	52,000	229	209
Steel plant No. 1	1.0	1.0	141,353,000	213,280,000	120,000	11,780,000	11,820,000	32,000	32,400
Steel plant No. 2	1.0	1.0	4,659,000	6,709,000	4,000	338,000	286,000	1,415	1,340
Steel plant No. 3	1.0	1.0	3,535,000	6,349,000	2,000	294,000	414,000	1,210	1,120
Water works	11.2	11.6	11,001,000	16,313,000	4,400	81,400	73,400	225	220
Wood working‡	.....	4.0	.....	419,000	400	.....	17,500	.....	519
Miscellaneous industries	4.7	5.0	1,081,000	3,075,000	3,830	19,000	34,100	121	165
All industries without public utilities	286.0	288.0	608,600,000	941,100,000	366,665	179,000	181,000	500	513
Total wholesale	300.0	298.0	1,121,930,000	1,789,070,000	602,915	312,000	502,000	868	922

* "Average Monthly Maximum Demand" is sum of the individual maximum demands for any one month divided by the number of customers for that month.
† Average on six-month basis.
‡ For six-month period ended June 30, 1927.
§ This figure is the maximum demand in kilowatts converted to horsepower.

period ended Dec. 31, 1926, and the eighteen-month period ended June 30, 1927. It should be noted that the "average monthly maximum demand" is the sum of the individual maximum demands for any one month divided by the number of customers for that month and is used here to give an indication of the size and demands of the customers in the various industries. With a company like the Alabama Power Company, serving nearly an entire state, it is obviously almost impossible to determine the maximum demand on the system of any one industry.

The most seasonal of all loads is the cotton gins and compressors, which are in use only from August to March. There are about 120 of these customers out of a total of 300. In almost all cases these customers have a power contract for the ginning season only. The total energy used by all industrial customers is fairly even throughout the year.

The tabulated energy consumptions per unit of output have been found to represent conditions fairly well in the Southern states particularly.

ENERGY CONSUMPTION PER UNIT OF PRODUCT FOR VARIOUS INDUSTRIES IN SOUTH

	Kw.-Hr.
Brick plants, per 1,000 bricks	30
Cement plants, per barrel	13 to 17
Coal mines, per ton	3 to 10
Cotton gins and compressors, per bale	14 to 17
Cotton oil, per ton	85
Fertilizer plants (acid phosphate), per ton	10 to 15
Pipe foundries, per ton	10 to 20
Job foundries, per ton	15 to 30
Ice plants, per ton	50 to 80
Ore mines, per ton	15 to 20
Steel plants, per ton	20 to 80
Water works, per 1,000 gal	2
Sawmills, per 1,000 ft	110

Utility Presents Lighting Laboratory to High School

AN ILLUMINATING engineering laboratory has been equipped for the Springfield (Mass.) Technical High School by the United Electric Light Company for use in the physics, chemistry and domestic science courses to illustrate a wide range of lighting practice. The equipment, which cost about $5,000, includes seven ceiling circuits on which obsolete and modern units and reflectors can be shown in operation; also wall circuits and auxiliary apparatus. Provision has been made for raising and lowering reflectors mechanically to study the effects of height of mounting, glare, etc., without interrupting service. Other fixtures permit illustrating four different types of indirect lighting each. The equipment also includes a model show-window box, a shadow box, compartments for displaying portable lamps, foot-candle meters and measuring instruments, a machine-tool lighting exhibit and a moving picture booth and screen.

A PIONEER HIGH SCHOOL LIGHTING LABORATORY AT SPRINGFIELD, MASS.

Curtains are provided to enable investigations of absorption to be made.

The United company gave the laboratory with the understanding that it would be used educationally and not commercially, and the work done in the installation is keyed upon conservation of eyesight and economic illumination through the co-operation of this utility. The laboratory was equipped under the direction of J. Frank Murray, head of the lighting department of the United company, assisted by John M. Howard, at the time attached to the lighting sales staff of the General Electric Company at Boston. H. B. Marsh is principal and E. H. Goodrich head of the science department of this high school in Springfield.

A Plea for the Prudent Investment Rate Base

Customers and investors assured of fair treatment despite price changes. Simplicity of application an advantage. Worcester case raises important points in regulation

By HENRY L. SHATTUCK

Chairman House Committee on Ways and Means, Massachusetts Legislature

THE appeal of the Worcester Electric Light Company from the recent decision of the Massachusetts Department of Public Utilities reducing its maximum or lighting rate has raised once more the question of valuation for rate-making purposes. The department, though its decision may be supported on other grounds, reiterates the time-honored principle of rate making in Massachusetts, that capital honestly and prudently invested must under normal conditions be taken as the controlling factor in fixing the rate base. The company contends, however, that the controlling factor should be the cost of reproducing new the existing plant, less depreciation, and relies on a number of decisions handed down by the United States Supreme Court which seem to be tending in that direction and away from the old rule of *Smyth vs. Ames*, which singled out no one factor as decisive.

HENRY L. SHATTUCK

Space does not permit a discussion of the court decisions. I shall confine myself to the broader question of public policy, believing that in the end the court decisions will follow those principles which sound public policy dictates. The layman often looks upon constitutional law as an exact science. In fact, however, especially when dealing with such broadly phrased clauses as the Fourteenth Amendment, the true construction depends more upon public policy than upon legal principles in the strict sense.

Therefore the question to which I shall address myself is whether in the long run the public, including investors in public utility securities, will be better served and protected by adopting the prudent investment theory of rate base or by adopting the reproduction cost theory.

I maintain that the prudent investment theory should prevail. It is simple in application. It avoids the enormous cost and uncertainty of valuations based upon expert testimony, in which guesswork plays a large part. It insures to the investor, so far as the volume of business will permit, a fair return upon his investment, whether in bonds or stock. While it denies a speculative return on unearned increment and on inflated values caused by rising price levels, it protects prudent investment made prior to a period of falling price levels.

As I have said, the prudent investment theory is simple in application. In Massachusetts we have cost records practically from the beginning, and we have maintained a continuous supervision and check-up of security issues. In other states the records are becoming more and more nearly complete. A determination of prudent investment can therefore be speedily arrived at, and there can be no substantial dispute regarding the figures.

Let us contrast the expense involved and the uncertainty of values based on reproduction cost. This method requires a detailed inventory, a determination of the probable cost of replacing each item, endless disputes as to whether the estimate is to be based on cost of reproducing the identical article or facility or merely on the cost of reproducing an equally or more efficient article or facility, and if the latter, what substituted article or facility would be at least as efficient as those then in use. There would also be much dispute as to the element of so-called "going value," and at best a pure guess as to how this should be figured. There would also be many other conflicting claims, as, for instance, whether the utility was entitled to add to its rate base by reason of the repaving by a city at its own expense of streets under which pipes of the utility had been laid. Until it became necessary to repair or replace these pipes, no additional investment on the part of the utility would be required. It has been claimed, however, that in advance

of any such additional investment a utility company is entitled to include in its rate base the cost of opening and replacing all new pavement, on the purely fictitious supposition of an immediate rebuilding of the entire plant. This example well illustrates the preposterous length to which public utility advocates have gone in support of swollen claims founded on the replacement cost theory of valuation.

Replacement Theory Leads to Costly Litigation

For the study of these questions and many others a large staff of experts and accountants must be employed by each side, and there must be long hearings, with voluminous testimony. At the end of all this, instead of a substantial agreement as to rate base, there would be an enormous twilight zone between the conflicting guesses of those employed by the company on the one side and those employed by public authority on the other, followed by expensive litigation involving both fact and law. This is well illustrated in the Worcester decision. In that case the Department of Public Utilities estimated the reproduction cost at not exceeding $10,000,000, whereas the company's estimate was $17,837,965. The extent to which figures may be juggled when experts begin guessing is further illustrated by the fact that for purposes of taxation the Worcester company had filed a return with the assessors, valuing its taxable property—which doubtless represented a large proportion of its total property—at $4,571,200.

The prudent investment theory, sticking as it does to figures which may be easily determined with substantial accuracy, avoids the possibility of financial legerdemain. Furthermore, the prudent investment theory insures a stability of rate base fair alike to the community served and to the investor. Frequent revision of rates up and down, and frequent reappraisals to meet the flucuations in cost of reproduction caused by changing price levels, shifting land values and other factors may be dispensed with. Capital honestly and prudently invested, whether in time of high or low production costs, is to have a fair return. The rate cannot be increased to meet fluctuations in unearned increment and in cost of labor and materials; nor can a decrease of rate be compelled to meet falling land values or falling costs of labor and materials. The balance is kept even. We avoid on the one hand mulcting the public in periods of rising costs, and on the other hand mulcting the investors in times of falling prices.

Old Theory Was Cause of Continued Prosperity

The gas and electric companies of Massachusetts should be the last to seek swollen profits through an attempt to upset our time-honored rule of prudent investment. Under the application of this rule they have had unexampled prosperity. They have received more than generous treatment. They should remember that if greed for immediate profits wins, there will be a day of reckoning when falling prices force drastic rate reductions. For it must be recognized that the utilities cannot have it both ways. They cannot have rates in times of inflation based on reproduction cost, and in times of deflation on prudent investment. In the meantime, as a protection against present demands if successfully prosecuted, it is certain that new impetus will be given to public ownership, of which we already have in Massachusetts numerous successful examples in the field of gas and electric lighting.

If You Don't Sell Appliances

By Ruel McDaniel

TO SELL appliances, or not to sell, has been a much discussed problem with electric utilities. Some companies that conduct merchandising departments declare that there is no profit in it, even though list prices are maintained, the benefit being realized from the increased consumption of energy. Others are able to increase the load on their lines and make some profit from the retail sales too. All agree, however, that only through the increased use of appliances can the domestic customers' energy consumption be built up.

A number of central-station companies operate under a policy that decrees that no merchandising shall be done. The San Antonio Public Service Company does not sell appliances, but it has worked out a method to meet this situation. The sale of electrical appliances is being promoted at small expense to the company, the dealers are in a happy frame of mind and consumption of energy in San Antonio is increasing.

DEALER'S DISPLAY ON FLOOR OF SAN ANTONIO PUBLIC SERVICE COMPANY'S SALESROOM

"It is against the policy of our company to merchandise appliances," explained S. J. Ballinger, advertising manager, "but we do encourage the dealers to sell. That is the key to our plan. We have been handling the appliance problem this way for five or six years now, and we have learned several things about it."

The company has two spacious display windows on one of the city's busy streets, and there is an excellent salesroom in the building. There is a local organization of appliance dealers and contractors, so the Public Service Company approached this dealer-contractor organization with a proposition whereby the dealers would utilize the display space of the company.

The company proposed to give each member of the organization an equal chance of using the display space; accordingly, the dealers were paired off, one gas man and one electrical man. Each group was to have the use of the space for one month. There were at that time thirteen electrical dealers in the local club; therefore, the time had to be divided into thirteen equal periods.

At the end of each thirteen months' period the various contractors and dealers meet with the Public Service Company and plans for the next period are made. One of the things done at these meetings is the drawing of numbers representing months, which determine the time that each dealer uses the display space.

A member of the new-business department of the Public Service Company is the company's contact man with the dealers and the public, assisting and advising the dealers in making their displays. The company encourages the retailers to prepare their own displays, but the most important thing is to have the display attractive, and if the retailer cannot arrange it attractively, the company undertakes the work.

The Public Service Company keeps a man on the salesroom floor to explain the details of the various appliances and to make sales. The company goes so far as to deliver the articles to the purchaser, unless it is a washing machine or some other large appliance, in which case the dealer makes his own delivery.

In addition to the display and selling service, the company runs newspaper advertisements on various appliances and mentions the names of the dealers that are displaying the article for the month. The retailers are encouraged to tie up with the company's advertisement with one of their own, although this is not obligatory. The body of the advertisement is devoted to the advantages of the appliances, and at the bottom usually is a paragraph calling attention to the dealers' display.

This plan has brought about a better understanding between the Public Service Company and the retailers. Knockers have been converted into boosters and complaints of unfairness have been lessened. Besides this good-will building, it has sold appliances, which is the chief aim of the plan.

Dempsey-Tunney Fight Returns

REPRESENTATIVE reports from a number of electric utilities indicate that the fluctuations in radio listeners' load and consumption due to the Dempsey-Tunney fight were subject to a regional factor. The fight fans who remained by the receiving set for several hours after their usual retiring hour apparently exerted an influence upon the loads of a majority of the lighting companies. New York, as reported in the ELECTRICAL WORLD of Oct. 8, consumed about 100,000 kw.-hr. in excess of the consumption recorded on the previous evening.

Boston, as determined by the Edison Illuminating Company, developed an increase of 50,000 kw.-hr. above normal. The greatest abnormality occurred around midnight, indicating a possibility of interest sustenance after the blows within the squared circle had ceased.

The Salem Electric Lighting Company, of Salem, Mass., whose average daily use in 1926 was 27,632 kw.-hr., reports an increase of 7,400 kw.-hr. over this value between 11 p.m. and midnight the evening of the combat.

The Public Service Corporation of New Jersey estimates that, in the northern division, the load at 10:30 p.m. was aproximately 10,000 kw. above that on the corresponding night in the weeks previous to and following the encounter.

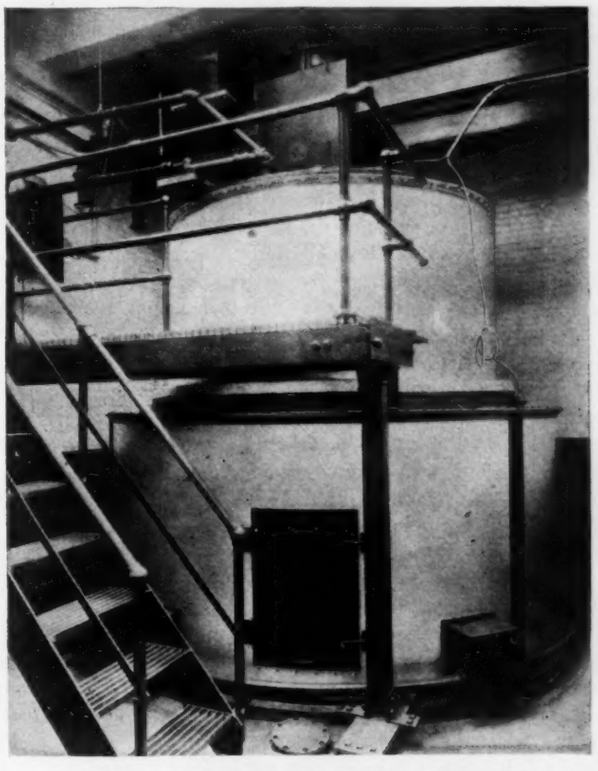
Detroit and Chicago companies did not participate in a load rise. The Detroit Edison Company found its load reduced by 12,000 kw., or about 5 per cent between the hours of 8:30 and 10:30, from the figures of the two preceding evenings. The Commonwealth Edison Company segregated its figures to eliminate railway, power, business district supply and direct-current data from the residential lighting load, but the analyzed results led to no significant conclusion. It is possible that so many of the Detroit and Chicago fans attended Mr. Rickard's party in person that the figures were altered thereby.

In the smaller communities there appears to have been a degree of interest and energy utilization commensurate with that evidenced in the larger cities. The municipal electric works of Wallingford, Conn., reports that the consumption on Sept. 22 exceeded the 3,640 kw.-hr. of the previous night by 520. The increase between 6 p.m. and 12 was 14.2, that between 9:30 p.m. and 12 was 20.4 per cent.

The Central Massachusetts Electric Company of Palmer, Mass., compiled data regarding the load on a small substation. These indicated that the peak load, although no greater, was prolonged further into the evening.

Electric Melting Economies and Avoidance of Fires

ELECTRIC melting of gum in the manufacture of varnish is accomplished with marked economies in the plant, the equipment of which is illustrated. In addition the removal of practically all fire hazards from



VARNISH GUM MELTED IN THIS KETTLE WITH ABOUT ½ KW.-HR. PER GALLON

the process is effected. Formerly in this establishment gum was melted in 100-gal. kettles rolled by hand over open-fire pits and requiring five men for a given volume of production. The electric kettle shown was designed by C. I. Hayes, Providence, R. I., and is rated at 225 kw., its capacity being 3,000 gal. It operates up to 700 deg. F. and requires but one man, with a helper part of the time. The old open-pit process was frequently the cause of fires and lost material. In nine months' operation the kettle melted 224,400 gal. of material with a total energy consumption of 121,100 kw.-hr., the cost of electricity ranging from 2.25 to 2.5 cents per kilowatt-hour.

Letters from Our Readers

Compares 132-Kv. Cables for Cost and Performance

To the Editor of the ELECTRICAL WORLD:

Captain Dunsheath, in a paper read recently before the British Association, presented data from which it would appear that the cost per kilowatt per mile for 132-kv. cables only is £0.10. It would be interesting to know the basis on which he got together his prices, as there is no cable of this rating at present upon the market in Great Britain. Possibly he has considered cable which is almost identical with that recently tried in Newark, N. J., tests on which have been given in some detail in the ELECTRICAL WORLD. Therefore, I will compare what could be done with a cable of this type and what with an "intersheath" cable.

The depth of insulation on the Standard Underground and the Safety Cable companies' cables has apparently been worked out on the basis of not exceeding a potential gradient of 60 kv. per centimeter, and this gives a depth of insulation of 30/32 in., the figure actually adopted. In my opinion, this large depth (24 mm.) for the impregnation of a paper cable is a mistake.

Among others, a serious objection is that, owing to the great depth of insulation, the heat cannot get away from the central core. From the data given in the ELECTRICAL WORLD I calculate that the thermal resistance per centimeter length is as high as 96.2. (It would look, from the data given in the ELECTRICAL WORLD, as though the cable were only guaranteed for 415 amp., from which it may be conjectured whether the British Engineering Research figure of 550 for K is as correct as the American figure of 750, or whether the duct system is the trouble.)

Comparing the foregoing results with certain results worked out for "intersheath" cable which I have had designed and tested, the thermal resistance between the outermost intersheath and the lead sheath of the cable is only 19.2 as against the 96.2 given above; i.e., only one-fifth of that of the American cable, and this is the only portion of the cable which is traversed by the heat units liberated in all the three cores.

Without going into details, I may say that for a cable buried direct in the earth I can utilize the present design of "intersheath" cable to transmit 138,000 kw. (compared with the 76,000 kw. offered by the United States makers) with an over-all internal drop of 19 deg. C., made up as follows: Central core to first intersheath, 6.3 deg. C.; first intersheath to second intersheath, 5.9 deg. C.; second intersheath to outer lead sheath, 6.8 deg. C.

The paper next to the second intersheath is obviously about 12 deg. cooler than that next to the central core; hence it might reasonably be worked at 66 kv. per centimeter, if compared with the New Jersey cable, where the temperature and power factor are so much higher and the migration of the oil outward is consequently more pronounced.

Therefore, if Captain Dunsheath has worked on the ordinary lines in getting out his curve of costs he may quite likely be 45 per cent to 80 per cent too high, on the cable part. Neither is it necessary to debit the cost of transformers in the case of cables used merely as an interlink with an overhead supply; but only where the cables are used *between stations* in a given city or town, and special transformation becomes necessary.

To withstand bending during laying, the intersheaths are made of considerably heavier section than the innermost core, and they therefore stiffen the cable very materially throughout its section (working outward) and press the papers closely together, preventing discontinuity between paper and paper.

It may be argued that it is not necessary to transmit such large powers per circuit, but it cannot be denied that it is necessary to have 100 per cent spare capacity where there are only two circuits and one is broken down. Hence the above 138,000 kw. becomes a normal rating of only 69,000 kw.

A. M. TAYLOR.

Slade Lodge, Erdington,
Birmingham, England.

Argues Industrial Rate that Gets Business Also Benefits Householder

To the Editor of the ELECTRICAL WORLD:

I have read with great interest the articles that have appeared in your publication from time to time on cost allocation, presumably as applied to rates, and the most recent article by Charles S. Reed of New York certainly points out some very definite inconsistencies in both the Hill and Greene methods. Is it not time, however, for the industry to call a halt to theorizing along these lines and let us consider those matters from a practical standpoint? Surely no one will contend that industrial and commercial customers should not be taken on merely because the revenue therefrom will not be compensatory when computed on the basis of any of the theories discussed.

In the majority of communities served by a central-station company the prosperity and wellbeing of the residence and other non-competitive customers is very closely bound up with the industrial and commercial activities. In consequence, if the rate for those latter consumers is made just low enough below individual plant or other competitive costs to be attractive, a most favorable rate situation can be brought about, satisfactory to all consumers. Unfortunately, in some cases, in the fight for business by reason of public utility competition, rates have been given to commercial consumers so far below individual costs that the residence consumers have been burdened in order to maintain a satisfactory return on utility property as a whole.

The writer knows of a utility that retails a large part of its energy for irrigation purposes and whose peak is as great for irrigation (and at times even greater) as for commercial purposes and at widely different periods of the year. An assignment of rates on any of the theories outlined in your publication as cost of service would make irrigation by electric pumping prohibitive and seriously curtail this agricultural activity. The cities in this community owe their welfare principally to the business built up from irrigated farming, and if the rate charged for irrigation is lower than the cost of procuring power by another means or from another source, the greatest benefit accrues to both the commercial center and the utility, provided, of course, that the low rate granted to irrigation does not result in a rate for commercial and industrial business so high that it cannot meet competitive service.

D. F. MCCURRACH,
Statistician and Rate Engineer.

Northwestern Electric Company,
Portland, Ore.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Chemistry of Coal.—R. V. WHEELER.—Because of the number and apparent complexity of the plant materials contributing to the formation of coal, the author concluded some years ago that the rational mode of study of coal would be to determine separately the character of the contribution made by each of the more important individual coal-forming materials of plants. This paper is intended to present a review of the progress achieved in a study directed along such lines. The various plant entities and residues that have contributed to the formation of the organic substance of coal are grouped as follows: those resistant to decay, including the spore exines and cuticular tissues and the resins; those subject to decay, including the organized, such as cellulosic, lignified and amorphous tissues, including the contents of plant cells, and the products of decay designated as the ulmins. The general nature of coal is, according to the author, best shown by its behavior under mild but prolonged oxidation which converts bituminous coal partially or almost wholly, according to composition, into alkali-soluble substances, leaving a residue that varies in amount and in character. It is stated that at present knowledge of the extent to which each of these main component groups of compounds affects the behavior of coal under different conditions is incomplete, but that it is possible to relate one or another property broadly to the presence of respective components. In those reactions of coal which involve its oxidation, the ulmin compounds play the major part, while the behavior of coal on destructive distillation, as regards its yield of tar, is determined mainly by its contents of resistant plant remains. The "coking power" of the coal depends on too many factors to permit of its being related so simply to the presence of one coking ingredient. The resins, and to a certain extent the hydrocarbons, appear to play the part of agglutinating materials, but the character of the infusible part of the coal is of equal importance. With the more complete knowledge rapidly being attained of the chemistry of the major components of coal, it is possible that direct advantage may be taken of their properties in order to utilize them in the most suitable manner.—*Engineering (England)*, Sept. 9, 1927.

Generation, Control, Switching and Protection

Short-Circuit Tests on Oil Switches.—J. BIERMANNS.—Two factors determine the proper size of circuit breaker to be used with a certain type of generator or transmission line—the maximum short-circuit energy which may occur at the switch and the rupturing capacity of the switch itself. The former can be calculated readily; the latter can be established reliably only by tests. A German concern has been using for the last fifteen years a specially designed 15,000-kva. short-circuit generator, with which experimental and standard oil switches have been tested up to a rupturing capacity of 150,000 kva. In late years the size of generators, transformers and complete power centers has, however, risen to such magnitude that nowadays circuit breakers of up to 1,000,000 kva. rupturing capacity are in demand. To keep up with modern requirements the concern is installing a 100,000-kva. short-circuit generator for circuit-breaker tests. In conjunction with a low-reactance 100,000-kva. transformer, circuit breakers for up to 150 kv. can be tested, breaking 1,000,000 kva. For closing tests several 100,000-amp. circuits are available with this set. Recent investigations with explosion-chamber breakers are described.—*Elektrotechnische Zeitschrift*, Aug. 11 and 18, 1927.

Transmission, Substations and Distribution

Anti-Vibration Installations. — The various methods of suppressing vibration and sound connected with the operation of machinery, and with particular reference to generators, rotary converters and other electrical machinery, are discussed in this article. No single cure for this class of disturbances is offered, but three methods of treatment which have proved applicable in a number of instances are described. Two of them embody the principle of absorbing the movements resulting from vibration by the use of springs. The third relies on the resilience of specially prepared cork panels to effect the same end. In some instances, where space limitation of one kind or another prevents the installation of foundation blocks of any effective mass, a device known as the pedestal-type anti-vibrator is fitted. This is a cast-iron box in two parts containing specially designed springs of helical or spiral type and having provision for adjustment. The boxes are fitted directly under the bedplate of the troublesome machine, which latter is bolted to the upper half of the box. The halves are bolted together in such a manner as not to interfere with their relative movement, and the lower half is bolted to the floor or foundation. When it is not desirable to raise the machine by the insertion of pedestals, because of the lack of head room and the necessity of maintaining the position of the axis, a bridge-type anti-vibrator has been adopted. The load is here carried upon beams the ends of which are suspended from the anti-vibrator springs. The method of utilizing the resilience of cork has been commonly adopted in large plants and those in which heavy foundation blocks can be employed. It is not intrinsically more suitable for these conditions, but where heavy weights are being dealt with it has the merit of being a definitely cheaper expedient. The principle of the system is that if a foundation block is large the energy of the unbalanced forces is absorbed more completely than if it is comparatively small, while the amplitude of the transmitted vibrations is correspondingly reduced. Consequently, by keeping the mass very large, the movement, while not damped out entirely, is kept so small as to be within the capacity of the cellular structure of the cork to deal with it. There are, it is stated, limits to the size of a foundation block, as the reduction of its original movement by one-half requires an increase of mass of four times. Mere weight without resilience cannot be effective. The cork is subjected to special treatment, being impregnated with a preservative which does not destroy its resilience but effectually preserves it against deterioration. It is prepared by cutting in strips, arranged end to end, and bound together in larger plates within an iron frame. These methods have proven pre-eminently satisfactory in a number of extremely difficult installations. It is sometimes necessary in order to secure external silence to admit air to the building or basement through a special conditioning plant.—*Engineering (England)*, Aug. 26, 1927.

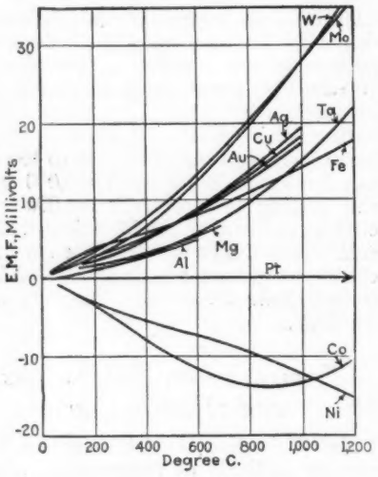
Heat Applications and Material Handling

Economics of Electric Generation.—P. S. GREGORY.—Electric steam generators for boilers and their attendant problems and economics are the major considerations involved in this article. The author says that the economics of electric boilers are based upon the fundamental relationship between the energy in a killowatt-hour and in a pound of steam. He has assumed one kilowatt-hour to be equivalent to 3,412 B.t.u. and one pound of steam under ordinary working conditions to contain approximately 1,000 B.t.u., so that one kilowatt-hour will produce in an electric boiler approximately three pounds of steam. Assuming that one ton of coal will produce 15,000 lb. of steam and that a kilowatt-hour produces three pounds of steam, one ton of coal can be replaced by 5,000 kw.-hr. At a cost of $5.00 per ton of coal a manufacturer can afford to pay 1 mill per kilowatt-hour for electrical energy to replace this coal. A price of 1 mill per kilowatt-hour will yield the power company about $6.50 per horsepower per year if the energy is used continuously. It is pointed out that the utilization of electrical energy

for the production of steam is economically feasible only under certain conditions, so that the contracts which a power company will enter into for the sale of electrical energy for the production of steam should contain a clause stating that such energy will be delivered if and when available only. It is for this reason that it is customary for the power company to own the electric boiler installation, and quite frequently contracts are made with customers at a price of so many cents per thousand pounds of steam generated. A rate of $6.50 for horsepower per year is sufficient to pay the bond interest on the cost of the generating machinery. The author explicitly states that in the present state of developments it is not possible to contemplate any economic utilization of surplus electricity for the heating of houses. The surplus energy is available when flood waters are present and when the spare capacity in the plant can be profitably utilized in the generation of electrical energy that can be sold for the production of steam to manufacturers who have a use for steam in their processes of manufacture or for heating their buildings. Power customers who purchase a constant amount of power, but who can vary manufacturing operations greatly, may find that they can afford to install electric boilers to use this surplus energy to produce steam.—*Electrical News (Canada)*, Sept. 1, 1927.

Units, Measurements and Instruments

Measurement of High Temperatures by Thermocouples.—The importance of the kind of metals used in forming a thermocouple has been considered in this article. The results of the experiments of Dr. W. Röhn indicate that when all factors, including cost are taken into consideration, the only metals suitable for thermocouples to measure temperatures up to 1,200 deg. C. are nickel and cobalt. Of these, pure cobalt cannot be used as one element of a junction, as it will be seen from the accompanying figure that there are two possible temperatures corresponding to each value of the electromotive force over a certain range. It has been found that an alloy of nickel and chromium may be successfully used to form a thermo-junction with pure nickel. Such a junction gives a practically linear curve of electromotive force against temperature, a value of about 40 millivolts being reached at 1,000 deg. C. in the case of a couple consisting of nickel and nickel containing 9 to 10 per cent of chromium. This proportion of chromium gives the maximum emf. at any temperature that can be obtained with a Ni-Ni-Cr couple. For temperatures not exceeding 600 deg. C. less expensive materials may be employed. The curves in the accompanying figure show the thermal emf. produced by each of the elements included when platinum is used as the other element of the junction. It is stated that elements which resemble each other chemically—that is, appear in the same group of the periodic tables—have similar thermal electric properties, so that only a relatively small emf. will be set up at any given temperature by a couple consisting of a pair of such elements. A couple consisting of two given metals has a definite emf. temperature relation if the metals are absolutely pure, so that any thermo-junction of these two metals will give the same emf. at a given temperature. The importance of a high state of purity for the metals is apparent. Where such conditions exist the galvanometer or millivoltmeter on which the emf. is measured may be calibrated directly in terms of temperature for a junction composed of given metals and



ELECTROMOTIVE FORCE INDUCED IN THERMOCOUPLES OF PLATINUM AND OTHER METALS

still allow an interchangeability of junction if the same two metals are used.—*Metallurgist (England), supplement to Engineer*, Aug. 26, 1927.

Electrophysics, Electrochemistry and Batteries

Cathodic Disintegration as a Method of Etching Specimens. — CYRIL S. SMITH.—The author describes a method that he has used with considerable success over a long period for the etching of certain alloys which, when etched by the usual liquid reagent, give results difficult to interpret, and it is suggested that cathodic etching should in some instances serve as a useful confirmation of other methods. The apparatus is essentially very simple and can be readily fabricated in any laboratory. A vacuum between 0.05 mm. and 0.005 mm. of mercury is used, and either direct or alternating current may be applied, about 15 milliamp. at a voltage of 2,000 to 7,500 being used, depending upon the gas pressure. It is stated that the cathodic process does not accentuate the scratches in the manner of the usual etching materials, but apparently removes them, giving a clear, usable micro-photograph. *Engineering (England)*, Sept. 23, 1927.

Miscellaneous

Graphical Analysis of Stress.—H. W. SWIFT. — The graphical construction known as the Mohr diagram has been used by the author in place of the analytical analyses commonly used in conjunction with mathematical work to determine stresses. It is stated that this graphical construction is worthy of more attention than it has received because it demonstrates clearly the relationship between the changes in value of the normal and tangential stresses at a point; it also enables the treatment of stress geometry to be made more convincing and accessible, and it facilitates the solution of a number of problems which would otherwise involve lengthy analytical work. The author has established a modified form of this construction in which the steps are chosen so as to permit of fairly simple demonstration. The treatment is two-dimentional throughout and the development is based on the proposition that by considering the statical equilibrium of a triangular prism and resolving stress components parallel and normal to any face, the values of the normal and tangential components of stress on any such plane can be determined when the stresses are known across any two other planes through the point under consideration, and that a plane may be assumed which passes through the point under consideration and across which the stress is purely normal, so that a simple application of the principle of moments to a rectangular prism demonstrates the normality of the stress on that plane. The thought is developed through a series of diagrams giving in detailed steps the successive procedures necessary to fully illustrate the idea. The author has explained his contention in connection with combined stresses, unsymmetrical bending, earth pressure, geometry of strain, thick cylinders and the like through mathematical and geometrical methods. — *Engineer (England)*, Aug. 26, 1927.

Farm Use of Electric Power.—F. RINGWALD.—Practical information concerning the performance of electric milking machinery, fodder-drying equipments and the electric illumination of chicken yards to stimulate laying is included in this article. Prejudice against new things and the conservatism of the average farmer has prevented the general introduction of electric milkers. Recently the Swiss Department of Agriculture, in co-operation with Swiss electrical interests, has provided a number of up-to-date electric milking equipments with which free demonstrations are being made to familiarize large farms with the advantages of this system. Cost figures are given, comparing hand and machine milking. Surprising results have been achieved by illuminating hen houses from 4 to 6 a.m. and 4 to 6 p.m. during the winter period. An automatic time switch controls one 50-cp. lamp for each 50 hens. It is stated that this has resulted, on the average, in a tripling of the number of eggs laid.—*Bulletin de l'Association Suisse des Electriciens*, August, 1927.

News of the Industry

John F. Gilchrist Honored by Industry

Friends and Associates of Vice-President of Commonwealth Edison Company Join in Commemorating His Forty Years of Service with That Organization

MONDAY of this week marked the completion of forty years of service with the Commonwealth Edison Company of Chicago and its predecessors by John F. Gilchrist, now vice-president of that company. In celebration of the occasion nearly eight hundred friends and associates of Mr. Gilchrist gathered at a dinner in the Palmer House, Chicago, to do him honor. The diners included not only members of the Commonwealth Edison organization but a large number of outstanding figures in the central-station and allied industries as well, whose presence demonstrated the effect that Mr. Gilchrist's personality and achievements have had in the national picture of industry accomplishment.

Vice-President E. W. Lloyd, the toastmaster, to whose efforts and those of his dinner committee the success of the occasion, so handled that it brought a spontaneous outpouring of esteem and affection for Mr. Gilchrist, was in great part due, read a message from President Samuel Insull wishing Mr. Gilchrist long life and continued success and saying: "I very much regret that owing to a slight indisposition it will be impossible for me to be present at the anniversary dinner tendered to John F. Gilchrist this evening and to express my great appreciation of him personally and the services he has rendered to various institutions with which he has been connected during his whole business career."

Speakers besides Mr. Lloyd were Martin J. Insull, Louis A. Ferguson and B. J. Mullaney, who united in a pæan of praise and recalled early days of their association with Mr. Gilchrist.

At the conclusion of his address Vice-President Ferguson presented Mr. Gilchrist with the Edison service button, commemorating forty years in harness, and with a solid silver service, the gift of those present. A huge sheaf of written tributes were read, leaders of the industry unable to be present and many of the diners as well uniting in the testimony. Brief extracts from some of these letters and telegrams which indicate the nation-wide regard in which the man who brought them forth is held follow:

JOHN W. LIEB, vice-president New York Edison Company: "He has rendered his company and the electrical industry a splendid and distinguished service."

R. H. BALLARD, vice-president Southern California Edison Company: "Heartiest congratulations from myself and associates upon this long and distinguished record of service to your company and the electrical industry."

J. F. GILCHRIST

ALEX DOW, president Detroit Edison Company: "I have known Mr. Gilchrist for the greater part of those forty years and I have always found him the same John Gilchrist—a master of his own job, a credit to our industry and a good friend."

J. F. OWENS, vice-president Oklahoma Gas & Electric Company: "One of the very great leaders of our industry. It is worth while to have lived through forty years of such development. It is more to have been one of the leaders in it."

P. S. ARKWRIGHT, president Georgia Power Company: "His devotion, his ideals and his successful accomplishments are an inspiration to all. The beauty about it is that he is still going stronger than ever."

LOUIS H. EGAN, president Union Electric Light & Power Company, St. Louis: "The electrical industry owes him a great debt for his unstinted devotion to its interests."

ARTHUR WILLIAMS, vice-president New York Edison Company: "His contributions have not only been of marked value in a technical way, but his splendid personality has been a distinct asset in promoting the high character generally of the men in the electrical field."

THOMAS N. MCCARTER, president Public Service Electric & Gas Company of New Jersey: "Mr. Gilchrist has been an outstanding man in the development of the electrical industry practically throughout its entire history. He is known and honored throughout the country for his contribution to the progress of the industry and he is one of the very strong men of one of the ablest organizations."

GERARD SWOPE, president General Electric Company: "I pay tribute to his doing what to me seems to be almost incomprehensible—serving forty years with so outstanding a company that has made such a distinct record of progress and achievement and yet being so young in mind, in interest, in energy and in body."

E. M. HERR, president Westinghouse Electric & Manufacturing Company: "Hearty congratulations on completion of this notable period of service and especially on splendid accomplishments in so fine an organization."

JAMES H. MCGRAW, president McGraw-Hill Publishing Company, Inc.: "For forty years he has gone forward in the same organization, carrying an accumulating load and winning an ever-broadening recognition in the industry because of it. Mr. Gilchrist, beyond question, has been the outstanding champion of broader sales policies and a potent influence in awakening the executive interest of the industry in the more practical problems of market building."

W. H. ONKEN, JR., editor ELECTRICAL WORLD: "John F. Gilchrist belongs to that body of men who prefer to wear out rather than rust out, and his friends have experienced great pleasure watching him evolve into a towering personality in the electric light and power industry."

Others who put themselves on record in similar vein were N. F. Brady, S. B. Way, Thomas E. Murray, Paul S. Clapp, Arthur W. Thompson, Henry L. Doherty, P. H. Gadsden, H. T. Sands, W. A. Jones, W. W. Freeman, Herbert A. Wagner, Frank A. Leach, Frank M. Tait, Thomas W. Martin, W. H. Atkins, Philip Torchio, James R. Strong, Preston S. Millar, G. E. Cullinan, H. M. Edwards, M. H. Aylesworth, Henry D. Shute and many more, including such prominent men in the Insull companies as those already named, Marshall E. Sampsell, Edward J. Doyle, John H. Gulick and Britton I. Budd.

Apparatus Men Hear N.E.M.A. Chiefs

Market Development Discussed at Division Meeting at Briarcliff, N. Y., by Swope, Curtin, Collens, Murphy, Sprackling and Waller

DEVELOPMENT of the market for electrical apparatus was the chief topic of the second meeting of the Apparatus Division of the National Electrical Manufacturers' Association, held at the Briarcliff Lodge, Briarcliff Manor, N. Y., this week. J. M. Curtin, vice-president in charge of the Apparatus Division; Gerard Swope, president of the N.E.M.A.; W. E. Sprackling, president of the Tubular Woven Fabric Company; Clarence L. Collens, vice-president in charge of the Policies Division, and D. H. Murphy, vice-president in charge of the Supply Division, all spoke on that subject.

Mr. Swope, in discussing the association's position in market developments, pointed out that its strength lies in its sections and section chairmen and that the parent organization simply makes the section work nationally recognized. In discussing the market situation, Mr. Swope said that if the only means of increasing sales for any company was to take existing business from another manufacturer in the field, the result would be unsatisfactory. The manufacturers' policy should be to build up the market and then take their normal share of the increased business that would follow.

Mr. Curtin pointed out that while the majority of the products of the Apparatus Division touch the public in only an indirect way as compared with the Supply Division, the efforts and success of the Supply Division directly affect the business of the members of the Apparatus Division. Mr. Curtin also called attention to the necessity for strong sections as the foundation for the organization structure.

Mr. Sprackling, in a series of questions and answers, explained what the market development program was and how it would affect the manufacturers. He explained how other industries had similar programs in force and pointed to the laundry industry, which has under way a program involving an expenditure of $5,000,000 per year for four years. He also referred to the joint committee on market development and said that this committee was organized and would function at an early date.

No doubt was expressed by Mr. Collens that an equitable plan of financing for carrying out the program would be evolved, and he said that the members could be assured of the support of the Policies Division.

Mr. Murphy spoke on how the development of electrical supply markets increases apparatus sales, and he also sounded a note of warning to the association to look carefully into the question of grounding of apparatus, which was a very intricate one, and to assure itself that any new rule would adequately serve the main purpose for which it was intended and not open up other avenues of possible trouble.

Alfred E. Waller, managing director of the association, at the conclusion of the addresses, referred by specific cases to the possibilities of market development in any branch of the industry and showed how impossible it was for any such development not to increase materially the market for nearly all other products. He said that there should be no question as to who should take part in the market development program or how, but rather it should be considered a privilege to undertake a part of this task.

McGraw-Shaw Company Enters Publishing Ranks

The McGraw-Hill Publishing Company, Inc., of New York and the A. W. Shaw Company of Chicago have just announced the incorporation of a subsidiary, named the McGraw-Shaw Company, to publish four long-established industrial publications: *Factory, Industrial Management, Industry Illustrated* and *Industrial Engineering.* The first two papers will be combined into one, to be called *Factory and Industrial Management,* and the third will be consolidated with *Industrial Engineering,* now published by the McGraw-Hill Publishing Company. The papers will be issued monthly.

The arrangement by which the two parent companies will control jointly the subsidiary is not in any sense a merger of the New York and Chicago publishers. Mr. McGraw will be chairman of the new company and A. W. Shaw will be its president.

Federal Trade Commission to Resume Electrical Inquiry

Taking testimony concerning the General Electric Company and other corporations in connection with an investigation of the manufacture, purchase and sale of radio devices and other electrical apparatus will be resumed by the Federal Trade Commission at a hearing to be held at 45 Broadway, New York, on Tuesday, Nov. 1, at 10 a.m. Alleged restraint of competition and creation of monopoly in the manufacture, purchase and sale of radio devices and apparatus and other electrical devices and apparatus, as well as in domestic and transoceanic radio communication and broadcasting, will be the subject of the inquiry.

Other companies concerned in the case besides the General Electric are the American Telephone & Telegraph Company, Western Electric Company, Westinghouse Electric & Manufacturing Company, International Radio Telegraph Company, United Fruit Company, Wireless Specialty Apparatus Company and Radio Corporation of America.

Rate Reduction Demand in Cincinnati

City Council, Acting on Report of Valuation Expert, Wants to Cut $750,000 a Year from Energy Charges of Union Gas & Electric.

FOLLOWING the reading in the Cincinnati City Council last week of a communication from the Union Gas & Electric Company rejecting a compromise proposal by which the company would have accepted a reduction of $500,000 annually in the electric rate schedule, an ordinance was unanimously passed establishing an electric rate based upon a reduction of $750,000. The new rate schedule was predicated upon a report recently submitted to the city by W. I. Hagenah, Chicago, utility valuation expert, in which it was stated that the present rate affords the company a return on its investment greater than is justified and that a reduction of $750,000 annually would be reasonable.

The ordinance did not contain an emergency clause, and consequently it will not become effective until Nov 18, and during this period it is subject to a referendum. Its acceptance by the company also is necessary, since in form it is a contract between the city and the company. That the courts may be invoked by the company appears probable and may result in prolonged litigation which, in a previous statement, the company sought to avoid.

Conclusions reached in the report of Mr. Hagenah are controverted by the company. Its letter, signed by President H. C. Blackwell, states that the $750,000 which, in the opinion of Mr. Hagenah, is available for reduction of rates, while a large amount in itself, in fact represents only 5 or 6 per cent of the gross earnings from the sale of electrical energy. "It is well known," Mr. Blackwell says in his communication, "that the variation in estimates and judgments of competent engineers in important rate valuation cases usually is at least 10 per cent and often more."

West Virginia Utilities Association at Parkersburg

The tenth annual convention of the West Virginia Utilities Association opened auspiciously on Wednesday at Parkersburg with more than two hundred delegates registered. Speakers on the first day included Paul S. Clapp of the N.E.L.A., Robert Soule of the Monongahela-West Penn Public Service Company and W. J. Wiegel, a Fairmont journalist. At the banquet in the evening J. F. Owens, head of the Public Relations National Section, N.E.L.A., and Governor Gore of West Virginia spoke and Judge L. N. Travenor of Parkersburg was toastmaster. A fuller report of the convention will appear next week.

Kansas Hears Attacks on Public Ownership

Salina Meeting of State Section of N.E.L.A. Enthusiastic and Successful —Is the Industry Partly to Blame for Attacks Upon It?

COMPENSATING with enthusiasm and earnestness for a somewhat smaller attendance than in the past, the thirtieth annual convention of the Kansas Section of the National Electric Light Association at Salina on Oct. 20 and 21 was declared by officers of the organization a marked and significant success. The falling off in attendance figures was ascribed by H. D. Hayden, retiring president of the section, largely to the many mergers and consolidations that have characterized the industry in Kansas as elsewhere within recent years.

Declaring that on the electric light and power industry rests the great obligation of upholding the principle of private ownership and individual initiative by which America has attained its present supremacy, William B. Harrison, president of the Union National Bank of Wichita, Kan., delivered a forceful address that evoked response. Thorne Browne, former chairman of the Nebraska Railway Commission and now managing director of the Middle West Division, N.E.L.A., also addressed himself to the subject of public ownership, declaring that the electrical industry must familiarize the people with the vital significance of the issue involved.

Insisting that the true function of a public relations worker is to reveal to the leaders of the industry its own deficiencies rather than to propagate an already recognized belief in its own virtues, H. Lee Jones, state bureau director, Topeka, expressed the conviction that the industry is now under indictment in many quarters because of policies and practices not predicated wholly upon entire honesty and unquestionable fairness. The present situation with its resultant feeling of uneasiness is the outgrowth of such practices and policies, he asserted, adding that in his opinion the industry must hold itself largely responsible for political attacks, newspaper criticism and proposals for public ownership.

Topics of commercial interest included "Radio Retailing as a Profitable Phase of Utility Merchandising," by Herbert Spokesfield, Kansas City Power & Light Company, and "The Kilowatt in Rural Kansas," by H. S. Hinrichs, Larned, Kan., who is field engineer of the Kansas Committee on the Relation of Electricity to Agriculture. The commercial sessions and program were under the direction of R. P. Ewing, Kansas Power & Light Company, Topeka, chairman of the Commercial Section of the Middle West Division.

Among the addresses on topics of general interest were those of Harry M. Turner, vice-president Missouri Valley Retail Coal Merchants' Association, Topeka, who spoke on "King Coal and Captain Kilowatt," and "What the Other Half Thinks," a talk on utility advertising by Keith Clevenger, public relations director Empire Companies, Bartlesville, Okla.

A feature of especial interest was the hour devoted to brief talks from former presidents of the Kansas Utility Association, R. T. Smalley, Lawrence, acting as chairman. Among those who spoke were W. W. Austin, Cottonwood Falls; L. O. Ripley, Wichita; A. M. Patten, Topeka, and Robert H. Timmons, Wichita.

Roy Bailey, editor Salina *Evening Journal,* was the principal speaker at the annual dinner, held at the Salina Country Club. The women of the convention also enjoyed a dinner and a special program on the opening night of the meeting.

Arthur Groesbeck, district manager United Power & Light Corporation, Manhattan, was elected president of the association; R. T. Smalley, Kansas Electric Power Company, Lawrence, was made first vice-president and Frank M. Stone, Kansas Utilities Company, Fort Scott, second vice-president, H. Lee Jones, Topeka, and P. F. Gow, Wichita, were re-elected to the respective positions of secretary and treasurer. The 1928 convention will be held at Wichita.

Utility Men Witness Tests of Hinged Cross-Arms

A demonstration of the effectiveness of steel towers with hinged cross-arms was afforded utility representatives on Oct. 21 by the Riter-Conley Company at Leetsdale, Pa. Eighteen utility and engineering companies were represented by about twenty-five men, a few electrical manufacturers' representatives also being in attendance.

For the test about one mile of transmission line had been erected using towers designed for 132-kv. operation, two circuits of 336,400-circ.mil aluminum-conductor steel-reinforced cables, the same size of ground conductor and spans of about 1,200 ft. All the conductor tensions in one circuit were approximately 8,000 lb., conforming with the N.E.L.A. class B loading. The towers were in appearance similar to ordinary towers, but the cross-arms were hinged near the tower so that they would swing into the direction of the line if a conductor breaks, thus relieving the stress on the tower. The second conductor from the top was broken first in making the test, and finally the bottom conductor. Several utility men who were asked their opinions of the design indicated that it had great merit which warranted further study and development. In both tests the hinged cross-arms on the tower adjacent to the break swung into the line about 80 deg., whereas those five spans away hardly moved, indicating that equilibrium of the conductors could be established within this distance. According to H. O. Hill, transmission engineer of the Riter-Conley Company, the towers tested weighed 20 per cent less than towers with fixed cross-arms designed for similar loading. Further observations will be presented later in the ELECTRICAL WORLD.

Purchases and Mergers

Stockholders of the American & Foreign Power Corporation this week ratified the proposal to acquire from the South American Power Company properties purchased in South America at various times by the Electric Bond & Share Company at a cost of $36,417,597.

North Birmingham, Ala., will vote on Nov. 15 on the proposed sale, already noted, of the municipal light plant for an aggregate price of $400,000 to the Birmingham Electric Company.

By a vote of 142 to 2 the town of Conover, N. C., has decided to sell its electric light plant to the Southern Public Utilities Company, the consideration being $35,000.

Shenandoah, Va., is advertising for bids for its municipal electric and waterworks plants. Waynesboro, Ga., will vote on the sale of its light plant on Nov. 4.

The New York Public Service Commission has approved the transfer by the Niagara, Lockport & Ontario Power Company to the Western New York Utilities, Inc., of franchises owned and distributing systems recently constructed by the Niagara company in the towns of Wethersville and Orangeville in Wyoming County.

Announcement is made of the transfer of the Milo Paper Mills at Penn Yan, N. Y., including all water power, to the Empire Power Company, which, as the holding company of the E. L. Phillips Company and the New York Central Electric Corporation, has been active in power developments in upper New York State for the last few years. The property is on Keuka Lake. The electric company now controls the water rights in 7 miles of outlet into Seneca Lake.

The Sherrard Power Company of Sherrard, Ill., has purchased the Rock Island County Power Company's entire electric utility holdings, chiefly distribution systems, and will operate the lines.

The Iowa-Nebraska Light & Power Company has purchased the distribution system from the City Council of Pleasant Dale, Neb., which it has served at wholesale, and also the distribution system at Pilger, privately owned. At a special election in Blue Springs, Neb., the voters by a substantial majority ordered the sale of their municipal plant.

By a substantial majority the citizens of Big Springs, Neb., have voted to sell the municipal electric plant to the Western Public Service Company.

The United Power & Light Corporation Abilene, Kan., has announced purchase of the municipal light plant at Delphos, Kan., which will hereafter be served from Salina.

The Northern States Power Company of Sioux Falls, S. D., will take over the Garretson (S. D.) electric light plant. The system will be entirely rebuilt.

The Harmony Light & Power Company of Harmony and Gillett Grove, Iowa, has been sold to the Iowa Public Service Company of Fort Dodge. The property consists of 21 miles of transmission lines.

Montpelier, N. D., has voted to bond the city for $4,200 to build a transmission line and to turn the city plant over to the Otter Tail Power Company, which has its headquarters at Fergus Falls, Minn.

Because of the sale of all the Ohio gas holdings of the Cities Service Company

to the Columbia Gas & Electric Company of New York, the Ohio Public Service Company withdraws from the gas field. The Cities Service had gas plants or lines in Alliance, Mansfield, Sandusky, Toledo and Wooster, Ohio.

The Eastern Electric & Development Company of Sackville, New Brunswick, Canada, has been sold, the purchaser being understood to be the Canada Electric Company of Amherst.

News comes from Montreal that the Abitibi Power & Paper Company is to enlarge its structure by taking in the Spanish River, Manitoba Paper, Fort William Paper and other newsprint plants in Canada. The consolidated concern will possess developed hydro-electric power in excess of 190,000 hp., with undeveloped power estimated at about 500,000 hp.

Asks that Colorado Conference Be Further Postponed

Recommendation that the date of the reconvening in Denver of the governors' conference on the Colorado River problem be changed from Nov. 7 to Nov. 21 is made in a communication sent to Governor Dern of Utah by W. B. Mathews of the California River Commission on Oct. 20. Desire for time for California, Arizona and Nevada delegates to reach an agreement on power revenue and water-division problems was given as the reason for seeking the delay. Robert Tally of Arizona and State Engineer G. W. Malone of Nevada concurred with Mr. Mathews in the recommendation. Mr. Mathews is the attorney for the Los Angeles Bureau of Power and Light.

Assurances that the national administration would not be opposed to any agreement reached by the seven Colorado River states for federal development of the river, including Boulder Dam, were given to George H. Dern, Governor of Utah, at the White House on Oct. 22 by President Coolidge, the Governor stated orally after a conference with the President.

Sacramento Defeats Public Plant Bond Issue

Municipal ownership suffered at the hands of the voters of the Sacramento (Cal.) municipal utility district when at a recent special election they failed to give an eleven-million-dollar bond issue the necessary two-thirds majority. The purpose of the bond issue was to develop a mountain water supply on Silver Creek, 60 miles distant, for the city of Sacramento and surrounding territory, which are included in a utility district created about four years ago. Power development is contemplated in the ultimate plan, it being the opinion of a board of engineers that a water supply and an initial power development of 90,000 hp. could be made at a cost of $27,000,000.

The proposal, placed before the voters on Sept. 27, was to spend $11,000,000 on water supply and as an initial step in the development of power. Out of a total registration of 37,400 there were 15,487 votes cast at the election, 8,701 in favor of the bonds and 6,786 against, the measure thus failing to receive the necessary two-thirds majority. A taxpayers' committee opposed the project.

Rocky Mountain Electrical Men in Line

N.E.L.A. Division, Meeting at Colorado Springs, Goes on Record Against Government Ownership of Utilities or Federal Encroachments

VIGOROUS opposition to government ownership of public utilities or federal encroachment upon their management and a willingness to carry this issue directly to the people were two outstanding ideas brought out at the joint annual convention of the Colorado Public Service Association and the Rocky Mountain Division of the National Electric Light Association, held Oct. 17-20 at the Broadmoor Hotel, Colorado Springs, Col. Another belief emphasized was that public relations work is not solely the function of a public relations department but the task of the whole utility company.

H. T. Sands, president National Electric Light Association, spoke on Monday on "Some Present-Day Problems" and paid tribute to the Rocky Mountain Division for past accomplishments. He said that if the movement for federal control of utilities is to be curbed, it is the obligation of every individual associated with the electrical industry to understand his business and to be in a position to disseminate the facts about it. Louis F. Musil, treasurer Cities Service Company, New York City, presented an excellent paper on "The Budget as an Aid in Management."

At Tuesday morning's session A. Jackson Marshall, secretary N.E.L.A., was followed by Herbert Metz, advertising manager Graybar Electric Company, New York, who spoke on "An Advertising Man's Views on Commercial Activities and Public Relations," urging that every prospective utility company employee be investigated as to whether or not in his daily routine activities he would develop to be a good public relations man.

"What We Need to Merchandise Appliances" was discussed by J. W. Devereaux, general commercial manager H. M. Byllesby & Company, Chicago.

P. M. Parry, commercial manager Utah Power & Light Company, Salt Lake City, presented a paper on the subject "The Electric Range and Water Heater as Load Builders," devoting most of his time to the topic of electric range sales. He dwelt upon the importance of conducting cooking schools and of backing up newspaper advertising by personal solicitation and demonstration.

E. W. Commery, assistant director of the research laboratory at Nela Park, Cleveland, presented a short talk on "Lighting Possibilities" and submitted statistics to indicate what might be expected from a well-thought-out plan to rewire and refixture the inadequately equipped homes of America.

Wednesday's program was devoted to "Engineering Practice and Policies in the Utility Industry." Chairman J. A. Clay of the rural electric service committee, who is general manager of the Western Colorado Power Company, Durango, referred to rural electrification as a rather thin business in the Rocky Mountain district but brought out the social and political benefits that will accrue through the extension of service to the farmer. It was the consensus of opinion that the problem is really not one of financing but rather of showing the farmer what power can do for him. As yet no determined effort has been made to introduce the electric range and refrigerator to him.

Other interesting papers were contributed by W. D. Johnston, general manager Mountain States Power Company, Casper, on "Power Survey"; by A. L. Jones, General Electric Company, Denver, on "Present-Day Prime Movers and Auxiliary Equipment"; by R. W. McNeil, Westinghouse Electric & Manufacturing Company, Denver, on "Tendencies in Electrical Development," and by E. C. Stone, Duquesne Light Company, Pittsburgh, on "The National Viewpoint of Progress in Utility Engineering."

Thursday's program was devoted to the subject of public relations. An address of unusual merit was delivered by J. F. Zimmerman, president University of New Mexico, Albuquerque, in which he referred to the very definite relationship that exists between social and business life in this country and urged that utility executives capitalize on this relationship. J. F. Owens, Oklahoma City, chairman Public Relations National Section, lauded Professor Zimmerman for his views and placed him on his public relations committee. Mr. Owens then outlined the effective work being done by the section. W. S. Vivian, Middle West Utilities Company, reiterated his belief that each utility employee is potentially a public speaker.

At the meeting of the Colorado Public Service Association it was voted to adopt a new constitution and to change the name of the organization to the Colorado Utilities Association. The administrative year is hereafter to be from July 1 to June 30, and the present officers will hold over until next July, when the following will succeed them: President, H. S. Robertson; vice-presidents, V. L. Board, R. M. Morris and R. W. Booze; secretary-treasurer, O. A. Weller.

For the Rocky Mountain Division of the N.E.L.A. the new officers will be: President, C. N. Stannard; vice-presidents, W. D. Johnston, J. A. Clay and J. E. Loiseau; treasurer, A. C. Cornell.

At the joint banquet of the two associations the speaker was Representative Charles A. Eaton of New Jersey, who spoke against government ownership. A novel feature of the convention was the taking of moving pictures of delegates, which were displayed at the banquet.

Edison as a Broadcaster

Great Inventor Answers Over the Radio Seventeen Questions Put Him on "Edison Night" by E. W. Rice, Jr., of the General Electric Company

"EDISON night—Friday, Oct. 21—saw successfully carried out the General Electric Company's nation-wide radio program in honor of Thomas A. Edison. Band music and short speeches by Gerard Swope and John W. Lieb were broadcast from 44 stations, but the event of greatest public interest was the dialogue between E. W. Rice, Jr., honorary chairman of the General Electric's board of directors, and Thomas A. Edison. This took place at the inventor's library in his home at West Orange, N. J., Mr. Rice asking seventeen questions to which Mr. Edison responded. The questions and the answers, which throw light on Edison's philosophy of life and his outlook for the future, were as follows:

Q.—Are you working as hard as ever? A.—Yes.

Q.—Do you think, Mr. Edison, that hard work shortens life? A.—Never, if you like it.

Q.—What, Mr. Edison, do you consider your most important invention? A.—The incandescent electric light and power system.

Q.—Does the present incandescent lamp retain the essentials of the first lamp made? A.—Yes.

Q.—What do you consider the greatest factor in human progress, comfort and happiness? A.—The introduction of electricity, power, telephone, etc., in our daily life.

Q.—Have the possibilities of electric invention and discovery been exhausted? A.—Oh, no. They appear endless.

Q.—You invented the phonograph in 1877 and the incandescent lamp in 1879, when you were a comparatively young man. Do you find, Mr. Edison, that most great inventions are made by men in their earlier years? A.—Yes, because they have greater energy and will to work.

Q.—At what age is man's productivity at the highest? A.—Depends entirely on his health, ambition and will to work.

Q.—Have any important inventions been made by women? A.—I cannot recall. Mme. Curie is a great research woman.

Q.—Do you believe, Mr. Edison, that a young man's opportunities for success are greater today than ever before. A.—Yes, far greater. There is a greater scarcity of competent men to manage our increasingly large industries.

Q.—Do you think, Mr. Edison, that the tendency in America will be toward bigger and bigger business? A.—Competent men are so scarce that there are not enough to go around. Hence large corporations are of advantage, as they can afford high salaries and thus obtain better management.

Q.—Will business ever get so big that it will be desirable to have it handled by the government? A.—Government management is fatal to success. The government should regulate, not manage, private business in its relation with the public.

Q.—From your experience, Mr. Edison, what advice would you give to the youth of today? A.—Youth does not take advice.

Q.—You once told me, Mr. Edison, that you were a great believer in light eating, and that you believed if most people ate less they would enjoy better health. Do you still believe this to be true? A.—Yes. My experience is that if people generally will diminish their food one-half, they will not lose weight and will have better health.

Q.—What period of your life do you look upon with greatest satisfaction? A.—After perfection of each invention the satisfaction is great. Then I plunge into another one, with all its trouble, to await another period of satisfaction.

Q.—Is life today a happier experience for the average man or woman than it has been in the past? A.—Yes, in the U. S. A.

Q.—Taking life as a whole, its successes and its disappointments, would you be glad to live it over again? A.—Yes.

Reorganized S. E. D. Is Going Forward on Four Lines

Preliminaries to the all-industry plan of operation built around the Society for Electrical Development reached a definite point on Oct. 19 when four planning committees, representing the interests of the National Electric Light Association, the National Electrical Manufacturers' Association, the Electrical Supply Jobbers' Association, the Association of Electragists International and the League Council, submitted recommendations looking toward the establishment of an adequately financed working program for the society before the turn of the year. The findings of the four committees included recommendations on the "red seal" plan, recommendations on codes and ordinances, recommendations on league and field service and recommendations on publicity and advertising services.

Previous activities of the society's committees along all these lines were indorsed and their expansion recommended except that it was thought the prevailing news service or publicity releases could be cut in half and still function better as an industry unit.

Industry Sales Conference to Be Held Soon

A call for an industry sales conference to decide upon the advisability of a comprehensive campaign to rewire and refixture the twelve million homes estimated to lack sufficient outlets has been issued by W. W. Freeman, president Society for Electrical Development, acting under acceptances by the presidents of the National Electric Light Association, the National Electrical Manufacturers' Association, the Electrical Supply Jobbers' Association and the Association of Electragists International. Nov. 4 has been suggested as the date for the first meeting, which, if not held then, will be as early as possible in November. The following members of the conference have been appointed:

N.E.L.A. — Harry McConnell, Electric Bond & Share Company, New York; E. W. Lloyd, vice-president Commonwealth Edison Company, Chicago; R. F. Pack, vice-president Northern States Power Company, Minneapolis; M. C. Huse, Philadelphia Electric Company; J. E. Davidson, vice-president Nebraska Power Company, Omaha.

N.E.M.A.—W. E. Sprackling, president Tubular Woven Fabric Company, Pawtucket, R. I.; H. T. Bussman, president Bussman Manufacturing Company, St. Louis; Robert Kuhn, president American Electrical Heater Company, Detroit; R. J. Russell, president Century Electric Company, St. Louis; David Sarnoff, vice-president Radio Corporation of America, New York.

E.S.J.A.—G. E. Cullinan, vice-president Graybar Electric Company, New York; W. W. Williamson, Alpha Electric Company, New York; J. G. Johannesen, president General Electric Supply Company, New York; C. McKew Parr, president Parr Electric Company, New York; John L. Owen, E. B. Latham & Company, New York.

A.E.I.—Joseph A. Fowler, president Fowler Electric Company, Memphis; W. Creighton Peet, president Peet & Powers, New York; A. Lincoln Bush, Belmont Electric Company, New York; J. H. Fryer, Berkshire Electric Company, Pittsfield, Mass.; W. H. Ochiltree, Ochiltree Electric Company, Pittsburgh.

League Council.—J. E. North, Electrical League of Cleveland; Earl Whitehorne, commercial editor ELECTRICAL WORLD, New York; R. Bourke Corcoran, Electric Association, Chicago; D. C. Birdsell, Decorative Lamp & Shade Company, Philadelphia; H. A. Brooks, Potomac Electric Power Company, Washington.

New Plan for Government Reorganization

American Engineering Council Changes Scheme to Obviate Creation of Another Department — Board Meeting Held at York, Pa.

WITH the support of Secretary Hoover of the Department of Commerce and of Secretary Work of the Department of the Interior, the American Engineering Council has adopted a new plan of executive reorganization affecting public works which, it is believed, will meet with favor in Congress and end a movement for administrative reform lasting forty years. The council, it is announced by its president, Dean Dexter S. Kimball of Cornell University, has recognized political expediency without sacrificing the essential principle involved in centralizing and placing on a business basis the enormous public works functions of the federal government, with which in the past, it is charged, waste and inefficiency have been associated. The proposals of the engineering profession have been embodied in a bill to be introduced at the coming session of Congress by Representative Adam M. Wyant of Pennsylvania.

Plans to further this program were made at a two-day meeting of the administrative board of the American Engineering Council in York, Pa., Oct. 20-21, under the auspices of the York Engineering Society. Its most striking feature is the abandonment of the idea of creating a Department of Public Works to replace the historic Department of the Interior, whose structure has been repeatedly denounced as archaic and wasteful. "Although the proposed Department of Public Works did not contemplate a new department," said L. W. Wallace, executive secretary, "it was undoubtedly construed as equivalent to such action. Hence the administration and Congress were reticent." Under the new scheme a major Division of Public Works would be created in

the Department of the Interior and would be directed by an Assistant Secretary of Public Works, who would be an engineer. This division would embrace all of the federal agencies concerned with public works functions. One notable provision is the inclusion of rivers and harbors in the new Wyant measure, notwithstanding anticipated opposition of positive kind, especially from the Engineer Corps of the army.

The new plan is the culmination of all of this engineering effort in the direction of the "rationalization of government business conduct." The American Engineering Council's committee on government reorganization, of which Gardner S. Williams of Ann Arbor, Mich., is chairman, is now in charge of the public works activity.

Holding Companies Are Attacked

State Commissioners Fall Foul of the Methods Followed by Some of Those Recently Established—Usefulness of Old-Line Controlling Corporation

HOLDING companies came in for much adverse criticism at the convention of the National Association of Railroad and Utilities Commissioners held at Dallas, Tex., last week and reported on page 853 of the ELECTRICAL WORLD. Not much fault was found with the older companies, but those formed by stock manipulators were subjected to a severe arraignment. In his presidential address John F. Shaughnessy referred to the situation diplomatically, but outspoken attacks on the holding companies were made in a round-table discussion presided over by Commissioner James S. Benn of Pennsylvania. President Shaughnessy, in speaking of the holding company, said:

"It is contended that in some cases these companies purchase public utility property at prices in excess of real value and turn them over to holding companies at a profit, which thereupon turn them over to operating companies for operation, resulting in detriment to either the using or investing public; that the investor desires and is entitled to sound securities, while the consumer is entitled to just and reasonable rates; that there is no room for pyramiding values and operating costs in the public service; that such holding companies exact unreasonable service charges from the subsidiary operating companies to cover executive, security, material and construction services; that these are matters of such importance that they should be subject to regulation as to their fairness, and that there has been a refusal on the part of some holding companies to disclose the details of those charges before commissions and courts. To the extent that these allegations are true it must be admitted that they will not stand the test of fair analysis and, if persisted in, must of necessity fall under the ban of just public condemnation.

"It is, of course, one of the major functions of the state commissions to prevent such practices. It should be understood, however, that we have combination holding and operating companies in the railroad and utility fields that consolidate a number of small companies by the purchase of stock control and thereafter build them up into a consolidated system of much financial strength and high-grade operating efficiency which enables such companies to furnish better service to the public at more reasonable rates and charges than would otherwise be the case under the independent operations of a number of weak rail and utility entities. This is obviously true. Such rehabilitated properties operated as a consolidated system, under a fair return on the reasonable value of such systems, generally afford a substantial margin within which the companies may appropriately improve the market value of the stocks and bonds of the subsidiary companies taken over. In so far as the stocks and bonds are strengthened by such consolidation, made under regulation, seemingly it is in the interest of the security holders, and not in violation of the public interest. But if a company pays in excess of the value of the property, either in the physical cost thereof or in the purchase of its capital securities, there is no rule whatsoever which binds a state commission to give recognition thereto in finding reasonable value of the property and fixing the fair return thereon to be earned by the rates charged to the consumers, which in all cases must be just and reasonable in excess of the value of the service."

ARGUMENTS PRO AND CON

The round-table discussion was begun by Halford Erickson, former chairman of the Wisconsin Railroad Commission and now vice-president of the Byllesby Engineering & Management Corporation of Chicago. Mr. Erickson set forth the purposes and value of holding companies in a masterly fashion, treating the subject from a purely economic standpoint, citing actual performances and savings in substantiation of his claim and detailing the benefits from large-scale operation made possible by holding companies, such as decreased costs, increased efficiency and lower rates to the public, together with larger and more secure returns to the investors.

Chairman Lewis E. Gettle of the Wisconsin Railroad Commission made a severe attack on the holding companies, declaring that the "secrecy and defiance on the part of holding companies toward state regulatory commissions have aroused hostility throughout the country. The books of the holding companies," he continued, "are in far-off, distant nooks and only the courts are allowed to see into them, although the operating companies which are controlled and owned by the holding companies are subject to public supervision and regulation. The public and the state commissions will not forever tolerate this attitude on the part of holding companies." Chairman Gettle also attacked the allowance of a supervisory charge which holding companies often make to their subsidiaries for engineering and other overhead work, mentioning particularly the American Telephone & Telegraph Company's charge of 4½ per cent.

Other speakers, including Chairman Prendergast of New York, said that their experience had not been so pronounced as to holding companies refusing to allow their books and records to be opened to state public service commissions.

Chairman H. E. West of the Maryland Public Service Commission cited numerous attempts made in that state to buy and consolidate small companies at exorbitant prices which the commission was able to check. The most insistent objection to holding-company practices, he said, lay in the charge that securities are sometimes issued by the holding company based on excessive values of subsidiary company investments. Virtually all the speakers participating agreed that the trouble just cited does not come from the older and more "solid" companies, but rather from "promotion schemes" wherein several smaller public utilities are bought up and securities issued by the new holding company to the investing public.

SIZE NOT THE CRITERION

A different viewpoint on holding-company operators was presented at Friday's session by the committee on the service of public utility companies. In his report Thomas E. McKay of the Utah Public Utilities Commission said:

"Much has been reported of late about the gigantic combination of capital that is seeking to gain control of these utilities. This is particularly true of the electrical industry, the growth of which in the past few years has been phenomenal; but so long as they render efficient service to the public at charges that will yield no more than a fair return upon the value of their property, and so long as they are supervised and regulated by our state commissions, which are in close touch with them in their various states, we are not so much concerned with the size they attain. The very dependable service being rendered today to the public of our various states by these utilities has been made possible by and is due very largely to having permitted them to combine and coordinate smaller properties, thereby eliminating wasteful duplications of service."

Briefer News

BUFFALO'S NEW SUBSTATION.—No. 18, the newest substation in the chain of Buffalo's power distribution system, is about completed and the transformers are being installed, with provision for the ultimate installation of 35,000 kw. This station, in the heart of the rapidly growing Bailey Avenue section, will take some of the load from stations Nos. 4 and 5.

MARTINSVILLE, VA., PLAYS SAFE.—The town of Martinsville, Va., which has on two occasions refused to sell its municipal electric plant to the Appalachian Electric Power Company, has made an agreement with that company whereby the latter's line can be tapped in an emergency or if the demand for power exceeds the capacity of the municipal turbines.

A HUNDRED MORE MILES OF TRANSMISSION LINE IN NORTHWEST TEXAS.—Important extensions of its electric power transmission system in northwest Texas are being made by the Texas Utilities Company, following enlargement of its power plant at Plainview. During the last few weeks the company has completed the construction of a power-line extension of 25 miles from Ralls to Floydada and a 26-mile extension from Southland to Post. Another extension of 25 miles from Littlefield to Levelland will be started soon, also an extension of 30 miles from Lockney to Silverton.

NEW HYDRO PLANT FOR BACK RIVER DISTRICT IN QUEBEC.—Construction work on the hydro-electric plant of the Montreal Island Power Company at Back River, the first power development to be carried out in that district in a good many years, will be actively under way in a short time. It is estimated that the site, under a head of 26 ft., is capable of developing 65,000 hp. of twenty-four-hour power. Construction plans are based on the delivery of 48,000 hp. by the end of 1929, provision being made for increasing the capacity to 65,000 hp. at minimum cost as required. Tenders for turbines will be invited soon, either for six 8,000-hp. or for four 12,000-hp. units.

PRELIMINARY WORK ACTIVE ON "QUADDY" TIDAL PROJECT.—The offices of Dexter P. Cooper, Inc., engineers promoting the Passamaquoddy Bay (Me.) tidal power project, have been moved from the Acme Theater building to the Seacoast Canning Company building at Eastport, Me., to provide increased space for the engineering and designing staff associated with this development. The Canadian Dexter P. Cooper Company will retain its present offices at Campobello, N. B., as headquarters for survey parties. Additional space on a local dock is being taken to provide for hydrographic and experimental work. No construction work has as yet been attempted on the project, but it is hoped to start this early next year.

RAILROAD WILL FIGHT PROPOSED HYDRO PLANT IN ROYAL GORGE.—Although the Public Service Company of Colorado is understood to have the indorsement of the municipal authorities at Canon City, Col., for the construction of a hydro-electric plant at the Royal Gorge, in the Arkansas River, the Denver & Rio Grande Western Railroad Company maintains that the construction of the plant will mar the scenic beauty of this spot and will contest any effort to build the proposed plant. The Royal Gorge is just beyond Canon City, and the tracks of the railroad pass through it. The project was noted in the ELECTRICAL WORLD for Aug. 27 (page 426).

THOMAS DAVENPORT HONORED.—The tablet shown here was recently installed at Williamstown, Vt., in honor of Thomas Davenport, blacksmith, pioneer

inventor and builder in 1834 of an electric motor, to which patent No. 132 was granted and which, it has been maintained, would, if in force today, cover every electric motor in existence.

HOUSTON COMPANY WILL ADD 40,000 KW.—Demand for electric power in Houston and the surrounding territory is increasing so rapidly that the capacity of the power plant of the Houston Lighting & Power Company at Deepwater, on the Ship Channel, will soon be increased by about 40,000 kw., at a cost of approximately $4,000,000, according to S. R. Bertron, Jr., vice-president and general manager. The company has two plants on the channel now, the Gabel Street plant, with a capacity of 32,500 kw., and the Deepwater plant, with a capacity of 65,000 kw.

RURAL AND CITY IMPROVEMENTS OF OHIO PUBLIC SERVICE COMPANY.—With 65 miles of rural construction costing approximately $130,000 completed, the Ohio Public Service Company is starting to reconstruct power lines in the business district at Alliance, which will require two months' time and an expenditure of $25,000, according to C. C. Henderson, division manager. To prevent any possibility of a general interruption of service the business district is being sectionalized, although Alliance, which is served by Warren, 35 miles away, and Canton, 18 miles distant, has a record of nearly two years during which there has been no general service interruption.

GREAT LAKES POWER CLUB FORMED.—At a meeting of Commercial Section committees of the Great Lakes Division, N.E.L.A., held in Chicago on Oct. 20 to make plans for the ensuing year, organization of the Great Lakes Power Club was completed. This club, composed of power sales engineers from utilities in Michigan, Indiana, Illinois and Wisconsin, will have as its object the study of power and industrial electric heating applications with particular reference to central-station service, thus aiding and supplementing the work of the Great Lakes power and heating committee. E. A. Armstrong of the Public Service Company of Northern Illinois was elected president of the club, A. D. McLay, Detroit Edison Company, vice-president, and E. R. Elam, Central Illinois Light Company, secretary. The next meeting will be held in Milwaukee on Jan. 13.

CUMBERLAND FALLS SITE PURCHASED OUTRIGHT BY INSULL INTERESTS.—The Insull-owned Cumberland Hydro-Electric Power Company, applicant to the Federal Power Commission for a license to build a power project at the site of Cumberland Falls, Ky., exercising an option which would have expired Oct. 16, has purchased the falls and surrounding property. In the meantime a second option had been obtained by former Senator T. Coleman du Pont of Delaware, a native of Kentucky, who meant to present the property, if he got it, to the state. Opposition to a water-power plant at Cumberland Falls has been manifested by the Kentucky State Parks Commission and the National Conference on State Parks. Opponents of the plan assert that more power could be developed at a point 8 or 10 miles away, on Wolf Creek, without detriment to scenic beauty.

PACIFIC GAS & ELECTRIC PROGRESS.—The latest of the Pit River construction jobs to be finished and made a part of the Pacific Gas & Electric Company's system is the Pit No. 4 diversion dam. Although the Pit No. 4 hydro-electric generating plant has not yet been built, the new dam was at once put to work to serve as an afterbay for Pit No. 3. By backing up the waters of the river, it assures an even stream flow below the power house and makes certain that the supply of irrigation water to downstream territory will not be disturbed. The dam is a composite masonry structure, 400 ft. in length and rising 68 ft. above the bed of the Pit. Another present undertaking by the company is a new substation on Ninth Avenue near Judah Street, San

Francisco, to serve the municipal railway. It will cost $181,000 and be known as Station N.

PLATTSBURG (N. Y.) COMPANY MOVES HEAD OFFICE TO MECHANICSVILLE.—The main office of the Plattsburg (N. Y.) Gas & Electric Company has been moved from that city to Mechanicsville, Saratoga County.

MANITOBA HYDRO LINKS TEN MORE TOWNS.—Hydro power was turned on in ten towns in Manitoba recently, following the completion of extension work by the provincial Hydro-Electric Power Commission. These towns include Jordan, Altamont, Manitou, Darlingford, Summerset, Swan Lake, Cardinal and Notre Dame des Lourdes. Several others will soon be added, including Crystal City and Glenboro.

MUNICIPAL OWNERSHIP IN NEBRASKA.—The trend away from municipal ownership and operation of electric plants continues in Nebraska. The voters of Wilber have refused to sanction a bond issue for a municipal plant and will renew contract with a locally owned hydro plant. Dorchester's Council turned down a suggestion for a plant and has renewed its contract with the Iowa-Nebraska Light & Power Company. The City Council of Beaver Crossing has indefinitely postponed consideration of the proposal to utilize an artesian well as the nucleus for a hydro-electric plant and has renewed its old contract with the Iowa-Nebraska company.

SOUTHWESTERN GAS & ELECTRIC EXPANSION.—In announcing the acquisition of new Arkansas properties, the Southwestern Gas & Electric Company said recently that, in order to serve the properties, transmission lines will be constructed from Ashdown, Ark., to Foreman, Ark., and from Hugo, Okla., to Wright City, Okla., utilizing the present lines between Wright City and Foreman, thus making a high-capacity line joining the Southwestern Gas & Electric Company property to the Public Service Company of Oklahoma property at Hugo. This will make available to this whole territory power from the Southwestern Gas & Electric plants at Shreveport and Texarkana. Work will start soon on the installation of 5,250 kw. in generating equipment at Texarkana.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Nov. 2. T. D. Bond, C. H. Tenney & Co., Boston.

National Electrical Credit Association—Philadelphia Division, Nov. 11; New York Division, Dec. 13. F. P. Vose, 1008 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Book-Cadillac Hotel, Detroit, Nov. 14-18. F. Overbagh, 411 S. Clinton St., Chicago.

National Electrical Manufacturers' Association — Radio Division, Edgewater Beach Hotel, Chicago, Nov. 28-Dec. 1. S. N. Clarkson, 420 Lexington Ave., New York.

American Physical Society—Chicago, Nov. 25-26; Nashville, Dec. 28-30. H. W. Webb, Columbia University, New York.

National Association of Utility Secretaries—Oklahoma City, Dec. 5-7. E. F. McKay, 307 Local Bldg., Oklahoma City.

American Society of Mechanical Engineers—New York, Dec. 5-8. C. W. Rice, 29 West 39th St., New York.

Commission Rulings

SELECTION OF ROUTE FOR RIGHT-OF-WAY UNDER CONDEMNATION PROCEEDINGS A MATTER FOR COMPANY TO DECIDE.—The Counties Gas & Electric Company in condemning a right-of-way for a transmission line in Montgomery County, Pa., had a choice between park property belonging to the state on the south side of a highway and private property on the north side. Both owners objected, and the company, rather than encounter delay, agreed that if the Park Commissioners would allow it to build on the public property, it would remove the line within a year. The company then tried to condemn a permanent right-of-way on the private property opposite, but the owner appealed to the Pennsylvania Public Service Commission, maintaining that the south side of the road was the preferable site and that the consent of the Park Commissioners was not essential. The Public Service Commission overruled the objection, quoting a former court decision as follows: "Manifestly, the selection of the route for the lines is a matter for the light company in the first instance and, unless it is shown that it proposes to exercise the powers conferred upon it wantonly, corruptly or capriciously, or that the rights of the land owner have been trifled with or unreasonably disregarded, the law does not contemplate that the commission should withhold its approval simply because another route might have been adopted."

COMMISSION DISAPPROVES LINE BUILT BEFORE APPLICATION FOR APPROVAL.—Denying an application by the Mutual Light & Power Company for approval of a completed 6,600-volt transmission line to serve the village of Rocheport, against which a telephone company had protested, the Missouri Public Service Commission said that the commission had no authority to approve the construction of distribution systems and transmission lines which had been constructed and put in operation without commission authority. Failure to obtain such authority by persons familiar with the legal requirements cannot be excused because the commission grants authority for such construction, when properly supported by sufficient data, without a hearing, said the commission, which also asserted that a transmission line overbuilding telephone lines, and not constructed in accordance with the rules and regulations contained in the National Electrical Safety Code, particularly in regard to clearance and pole-top diameter, was so constructed that it could not be operated in a safe manner.

Recent Court Decisions

MUNICIPAL PLANT MAY WIRE RANGES.—The Circuit Court at Jacksonville, Fla., has denied the petition of Edward Haimler noted on Oct. 8 (page 756) for an injunction to prohibit the city from doing electric wiring inside of homes when installing electric ranges. It has been the practice of the city electrical department to install wiring from the meters to the ranges when selling stoves and make a nominal charge therefor. It was contended by the petitioner that the charge was less than the work cost and that the work should be done by outside electricians.

RIPARIAN LAW EXPOUNDED.—Humphreys-Mexia Company vs. Oil Well Water Company was a suit to enjoin the defendant from diverting water from a reservoir made by a dam constructed by the plaintiff across the Navasota River. The Supreme Court of Texas found that a riparian proprietor had the legal right to take riparian water from a stream for use or sale unless his doing so interfered with some other riparian owner; that one authorized to appropriate flood water, not being a riparian owner, could not enjoin diversion of riparian water by riparian proprietor since he had no justifiable interest in riparian water; that water when it comes to rest in a basin made by nature for that purpose, although it was flood water at one time, ceases to be flood water and becomes a lake or pond; that riparian rights attach to all natural lakes and ponds regardless of origin; that the statute authorizing impounding of water does not grant right to appropriator or lower riparian owner to back water over property line of upper riparian owner, and that one authorized to impound and appropriate flood waters who trespassed on upper riparian owner's land by backing water over his property line is not entitled to maintain on the ground of trespass a suit in equity to enjoin the upper owner from diverting water. (297 S. W. 225)*

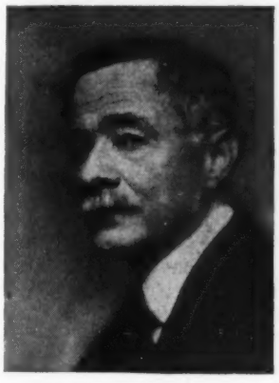
UNITED STATES SUPREME COURT UPHOLDS COMMISSION'S JURISDICTION.—Washington University and other consumers in St. Louis lost their fight against increased rates by the Union Electric Light & Power Company when the United States Supreme Court on Oct. 24 dismissed their appeal from an adverse decision of the Missouri Supreme Court on the ground that no substantial federal question was involved. No written opinion was filed by the court. In 1917 the company applied to the Missouri Public Service Commission for increased rates for electrical energy in St. Louis and the other Missouri communities it serves and also for higher rates on steam supplied to certain consumers in St. Louis. Both petitions were granted, although rates modified from those proposed by the company were ordered. Various consumers filed suit, attacking the increases, naming both the company and the commission as defendants and contending that the commission lacked jurisdiction to order the increases. The trial court and the Missouri Supreme Court both held otherwise, and this decision will not be disturbed by the United States Supreme Court.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

John Fritz Medal Awarded to J. J. Carty

John J. Carty, a vice-president of the American Telephone & Telegraph Company, New York, and a past-president of the American Institute of Electrical Engineers, has been unanimously awarded the John Fritz gold medal for 1928 for achievement in telephone engineering by the board of sixteen representatives of the American societies of civil, mining and metallurgical, mechanical and electrical engineers. Mr. Carty has probably done more than any other man toward the development of modern telephone engineering, having conducted scientific researches the results of which led to epochal advances in



J. J. CARTY

the theory and operation of telephone systems. Numerous tributes have been paid to Mr. Carty both in this country and abroad in the course of his distinguished engineering career.

Mr. Carty's first affiliation was with the Telegraph Dispatch Company of Boston in 1879. Some years later he became identified with the Western Electric Company, at first in charge of the cable department and subsequently of the switchboard department. In 1889 he entered the service of the Metropolitan Telephone & Telegraph Company, now the New York Telephone Company, as electrician, being later appointed chief engineer of the American Telephone & Telegraph Company. Mr. Carty is an officer or member of many scientific and engineering associations.

EDWARD DEAN ADAMS, engineer-financier and vice-chairman of the board of the United Engineering Society, was the chief speaker at a dinner given at the Union League Club, New York, on Oct. 20, the occasion marking the American engineers' official participation in the fifth centenary celebration of the University of Louvain, Belgium, June 28 and 29. Mr. Adams made a report of his mission as delegate of the Founder Societies and the Engineering Library, describing the post-war conditions of the Belgian center of learning. He proposed that a clock and carillon for the tower be presented by the Engineering Foundation in memory of American engineers who died in the World War. Resolutions indorsing Dr. Adams' proposal of the gift, which will cost approximately $70,000, and a special resolution of thanks for his mission were unanimously agreed upon.

T. N. McCarter Honored by Employees

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, Newark, was given a surprise party on Oct. 20 by about one thousand employees of the company on the occasion of his sixtieth birthday.

C. F. Brush Visits Schenectady

Charles F. Brush of Cleveland, who gave New York its first commercial system of electric arc lights, was the guest of the General Electric Company at Schenectady this week. As this was his first visit to the General Electric Company, his official hosts, Dr. Willis R. Whitney, director of the research laboratory, and E. W. Rice, Jr., honorary chairman of the board of directors of the company, conducted Mr. Brush on a tour of inspection through the laboratory and plant. Mr. Brush was on his way to a conference at Franklin Institute, Philadelphia, where, in co-operation with Elihu Thomson, he was to plan an observance of a 50-year electrical anniversary.

W. J. HEINRITZ, who was formerly associated with the Sioux City Gas & Electric Company, Sioux City, Iowa, is now superintendent of the electrical department of the Southwestern Gas & Electric Company, Texarkana, Ark.

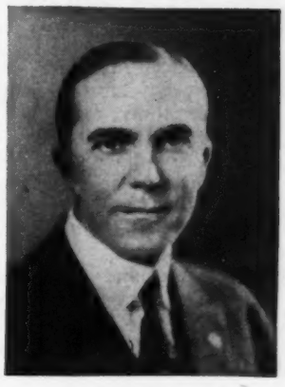
FRANK H. GOLDING, general manager of the Cambridge Electric Light Company, has been appointed general manager of the New England Gas & Electric Association, following the establishment of the association's headquarters at Cambridge.

HARDING U. GREENE, for the past three years general manager of the Cape & Vineyard Electric Company, Falmouth, Mass., and formerly of the engineering department of the J. G. White Management Corporation, New York, has been appointed assistant general manager of the Cambridge Electric Light Company. W. E. MANGER of the Staten Island Edison Company has been appointed general manager of the Cape & Vineyard company.

Obituary

Harry L. Brown

Harry L. Brown, secretary of the Ohio Brass Company, Mansfield, Ohio, died suddenly on Oct. 23 following an operation for acute appendicitis. Mr. Brown joined the Ohio Brass Company early in 1925 following an association with the McGraw-Hill Publishing Company which covered a period of ten years. Starting as an assistant editor of the ELECTRICAL WORLD in Chicago early in 1915, he was transferred the following year to the position of Western editorial representative



H. L. BROWN

of the *Electric Railway Journal* and subsequently was made Western editor. In April, 1922, he removed to New York to become managing editor of the *Electric Railway Journal* and in less than a year was made co-editor with Henry W. Blake and placed in executive charge.

A native of Michigan and a graduate of the University of Michigan in electrical engineering, Mr. Brown engaged in engineering work with the Aurora, Elgin & Chicago Railroad and the Chicago Telephone Company for two years before entering the field of technical journalism. While in military service he gave special attention to radio as first lieutenant and captain in the Signal Corps, and after the war he was co-author of a textbook on radio-engineering principles. Mr. Brown was a firm believer in the fundamental soundness of the electric railway industry and was an ardent advocate of measures to improve public relations and to merchandise the service, particularly those having to do with modernization of the railway plant and operating methods. Realizing the value of the bus as a new means of transportation, he was one of those who first urged its adoption as an auxiliary to the service of the railway companies.

Financial and Statistical News

Utility Stocks Turn Upward Big Investors in Market Bond Market Steady

THE inherent strength and prestige with investors of the common stocks of power and light companies were unusually well illustrated this week by the action of the markets after two weeks of declining prices. On the first intimation of an upward turn on the part of the usual market leaders—United States Steel, General Motors, General Electric, etc.—the utility stocks turned upward on large buying orders. On the New York Stock Exchange, for example, eighteen of nineteen listed power and light stocks showed substantial gains during the first day of rising prices. Brokers report that many of their customers have large buying orders for these issues, on recessions.

Among the large investors are numerous investment trusts, many of which have been only recently organized. The adaptability of such issues to the portfolios of these institutions is readily recognized, especially in the case of holding-company common stocks, in view of the wide factor of diversification involved.

Preferred stocks and bonds of the power and light companies have remained relatively steady of late. Bond prices have hesitated somewhat in their upward trend, and buying orders are reported as satisfactory but not exceptional. Very few new issues came forward this week.

Connecticut Light & Power Plans Stock Issues

The Connecticut Light & Power Company, Hartford, will hold a stockholders' meeting Nov. 17 to act upon the merger of the Bristol & Plainville Electric Company and the Middletown Gas Company into the first-named organization; to change its authorized and unissued $2,500,000 par value of second preferred stock to a like amount of common stock, thereby making the total authorized common stock $21,000,000 par value; to increase the common stock from $21,000,000 to $40,000,000, and to increase the authorized preferred stock from $15,000,000 to $30,000,000.

The merger of these properties into a single operating organization, President J. H. Roraback states, will enable more satisfactory results to be obtained than by separate organizations under common management. By the terms of the proposed merger, common stock will be issued to the Connecticut Electric Service Company, the holding corporation of these interests, in exchange for the Bristol and Middletown stock. The entire debt of these two companies is less than $900,000, and as the value of the property to be acquired by the merger is several times in excess of this amount, and as the net earnings of the two companies last year were over $260,000, the preferred stockholders' equity will be greatly increased and a material improvement made in the present and future position of the company. It is hoped that the additional preferred stock may be issued at rates of dividend ranging between 5 and 6½ per cent. The company has prepared a program for the development of its water-power resources covering a period of years.

CENTRAL MAINE POWER INCREASES PREFERRED.—The Maine Public Utilities Commission has authorized the Central Maine Power Company to increase its authorized preferred stock from $15,000,000 to $20,000,000, par $100.

PENN-OHIO EDISON PAYS STOCK DIVIDEND.—Directors of the Penn-Ohio Edison Company have declared the regular quarterly dividend of 25 cents per share in cash and an extra dividend of one-fiftieth of a share in stock, payable Nov. 1 to common of record Oct. 15.

Bankers' Association Analyzes the Investment Trust

Pitfalls That May Be Involved Are Pointed Out by Bankers in Session at Houston—Relation to General Financing —Speculative Trend Scored

MAINTAINING that many of the holding companies in the public utility field present some of the aspects of an investment trust, E. L. Smith, president of the Investment Managers' Company of New York, in an address before the trust company division of the American Bankers' Association, in convention at Houston, Tex., on Oct. 24 to 27, said that while the specific purposes for which these investment trusts are designed are economically sound and justify the creation of the holding company, nevertheless some of the practices which have grown from the opportunities for financial manipulation presented by the structure of the typical holding company cannot receive unqualified indorsement.

In appraising the value of an investment trust the speaker said one should determine whether the organizers are principally concerned with providing sound investment management or whether they are taking advantage of the present enthusiasm for investment trusts for the purpose of making quick and disproportionate profits for themselves. The British, he claimed, after many sad experiences, have come to rely mainly upon the character and ability of the men behind the investment trust. Nevertheless, countless trusts are being formed by people lacking in experience and with insufficient financial background and these trusts inevitably come to grief. Dealers in securities, Mr. Smith maintained, are not necessarily the ablest conservators of capital, and where the field of investment is too narrow unfavorable market conditions work havoc. While participation in a fixed list of securities is the easiest thing to sell, the supply may become so depleted that further purchases command exorbitant prices. Moreover, one must be sure, Mr. Smith asserted, that the financial structure of the holding company is sound, otherwise questionable speculative practices may arise.

It is obvious, said the speaker, that an investment trust should through proper restrictions insure a reasonable diversification in investments and that too great a proportion of the funds should not be placed in an industry concerning which the managers have too intimate a knowledge to the exclusion of a general knowledge of economic conditions. History suggests that an investment trust should contain restrictions to preclude the possibility that its sponsors may in times of stress be tempted to use the trust as a depositary for securities which would otherwise find no market; and yet, he claimed, if an investment trust be organized by a group of successful promoters or underwriters who use it to assist them in their business, it may prove to be extremely profitable for the subscribers to its shares. The speaker insisted that certain functions of great service to investors can be performed better through a soundly conceived investment trust under responsible and competent management than through any other agency.

L. H. Roseberry of the Security Trust and Savings Bank of Los Angeles was not so sanguine as Mr. Smith about the stability of investment trusts. He claimed that an investment trust is a device for dealing in stocks many, if not most, of which are frankly speculative. Proponents of the investment trust idea, he said, assume that there shall be losses, but frankly state that they expect such losses to be outweighed by exceptional profits. This double premise of possible losses offset by occasional speculative profits he thought to be repugnant to good trust-company policy. The theory behind trust company investment, Mr.

Roseberry said, is that there shall be no material fluctuation, and he doubted whether the history of investment trusts is such as to justify legalizing certificates or shares in such trusts for trust-company investment. Many British trusts, he asserted, have failed through lack of proper investment conditions or because of improper or incapable management. The investment trust unfortunately gives rise to many temptations and the human equation is uppermost.

Another objection raised by the speaker was that the management often refuses to publish a statement of holdings for fear of creating an unfavorable psychological effect upon the market. Yet Mr. Roseberry was frank to state that, in spite of well-established laws and customs, it is conceivable that the scientific study now being given investment companies may develop benefits to society which would justify a change in traditions and laws relating to trusts. He doubted, however, whether the time is now ripe to change the laws, to win seasoned and expert trust men to its favor or to convert the public mind to the idea.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Aug. 31 1927	1926
American Power & Light Co.	$62,228,903	$57,384,856
American Water Works & Electric and subs.	47,956,262	43,939,185
Bangor Hydro-Electric	1,848,722	1,657,975
Baton Rouge Electric	1,013,016	916,410
Binghamton Lt., Ht. & Pwr.	2,090,796	1,841,576
Blackstone Valley Gas & Electric and subs.	5,846,628	5,355,811
Carolina Power & Light	8,712,534	7,848,586
Central Illinois Light	4,350,169	4,113,567
Central Maine Power	5,427,628	4,996,297
Cities Service	30,875,519	22,385,810
Commonwealth Power and subs.	52,130,574	47,680,562
Consumers Power	25,968,042	23,003,617
East Texas Electric and subs.	6,821,632	5,366,820
Edison Elec. Illg. of Brockton	1,900,544	1,724,331
Electric Light & Power Co. of Abington and Rock.	608,190	572,583
El Paso Electric and subs.	2,952,301	2,712,669
Electric Power & Light	51,867,343	48,881,506
Florida Public Service	1,830,255	1,514,435
Fort Worth Power & Light	2,925,847	2,868,908
Galveston-Houston Electric and subs.	4,940,002	4,296,589
General Gas & Elec. and subs.	25,553,168	22,908,442
Idaho Power	2,982,115	2,858,658
Illinois Power	2,622,082	2,591,717
Illinois Power & Light	32,098,950	30,979,419
Kansas City Power & Light	11,820,932	10,655,592
Lowell Electric Light	1,765,343	1,703,522
Metropolitan Edison & subs.	10,182,933	9,320,552
Nebraska Power	4,676,049	4,311,221
New Jersey Power & Light	2,643,057	2,103,376
North Texas Elec. and subs.	2,581,063	2,517,806
No. Ohio Power and subs.	12,418,216	11,833,328
Ohio Edison	1,895,884	1,741,189
Pacific Power & Light	3,691,376	3,726,463
Penn-Ohio Edison	13,272,912	12,153,698
Portland Electric Power	12,084,401	11,437,754
Puget Sound Power & Light	14,455,774	13,239,950
Savannah Electric & Power	2,245,721	2,157,626
Sierra Pacific Elec. and subs.	1,258,788	1,186,479
Southern California Edison	30,041,320	26,654,530
So. Indiana Gas & Electric	3,011,177	2,820,681
Tampa Electric and subs.	4,824,131	4,539,021
Tennessee Electric Power	12,361,727	11,862,394
Texas Power & Light	9,025,238	7,301,849
Virginia Electric & Power and subs.	15,225,551	13,720,807

STOCK INCREASE VOTED FOR BUFFALO UTILITY.—Increases of 320,000 shares of preferred stock and 525,000 shares of common stock in the Buffalo, Niagara & Eastern Power Corporation were voted at a recent stockholders' meeting. While the preferred stock will be carried merely as an additional issue of the old preferred, the new common stock will be listed as "class A" and will have no voting privileges. It will carry a guaranteed dividend of $1 a year. The increases give the company a total capital stock issue of 2,500,000 shares of preferred and 2,625,000 shares of common of both classes.

New Capital Issues

During the week ended Oct. 27 the Georgia Power Company issued first and refunding mortgage gold bonds to the amount of $18,000,000, the price being 98 and interest, to yield about 5.12 per cent. Proceeds of these bonds will reimburse the company for expenditures for additions and improvements to its property already made and will provide funds for further additions and improvements and for other corporate purposes. These bonds were dated March 1, 1927, and mature March 1, 1967.

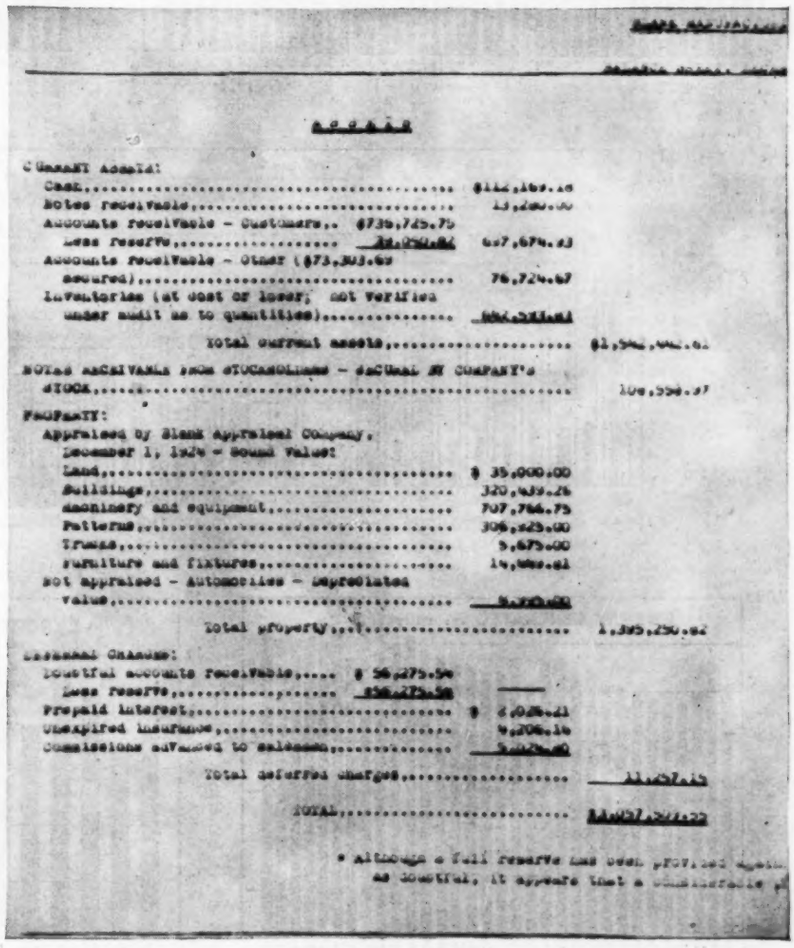
First trust mortgage gold bonds of the Nevada-California Electric Corporation were issued at 95½ and accrued interest, to yield over 5.30 per cent, a piece of financing involving a total of $2,750,000. These 5 per cent bonds were dated April 1, 1926, and mature April 1, 1956. Proceeds will be used partially to reimburse the treasury for expenditures on additions, extensions and improvements to permanent property since Dec. 31, 1925.

Utility Companies Apply the Telephotograph

Telephotography, which has made itself evident in the illustrated news of some large dailies, is being applied for business purposes by utility companies. Two examples just brought to the attention of the ELECTRICAL WORLD by the American Telephone & Telegraph Company are (1) the regular broadcasting of financial reports to assure dispatch and accuracy, and (2) the prompt and accurate reproduction at remote places of blueprints, plans, etc.

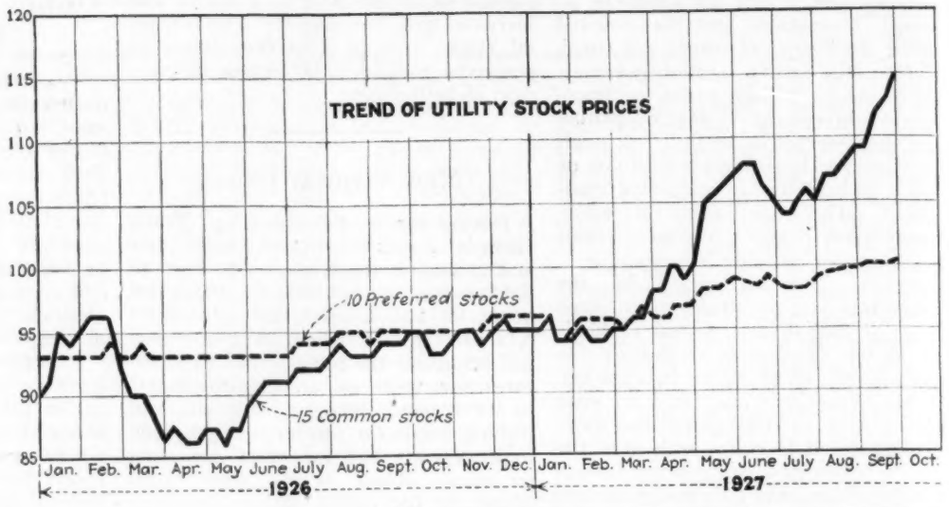
Reproduced herewith, to show the legibility of a telephotographically received balance sheet, is a portion of a financial report. The electric light and power company which broadcast this report does so regularly to assure simultaneous and accurate delivery of the facts at all parts of the country.

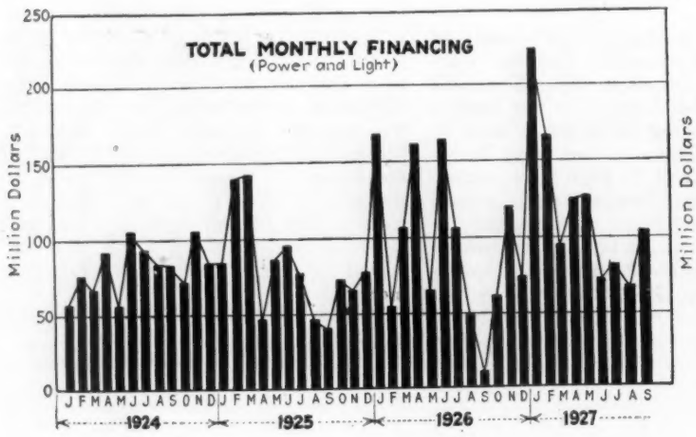
Recently the board of directors of an electric traction company desired unanimous approval of some plans under consideration. It was impossible to assemble the various members with sufficient promptness to prevent a serious delay in operations. Telephotography came to the rescue. The plans, with diagrams were flashed to four separate cities and received the desired analysis and approval in record time, with gratifying results.

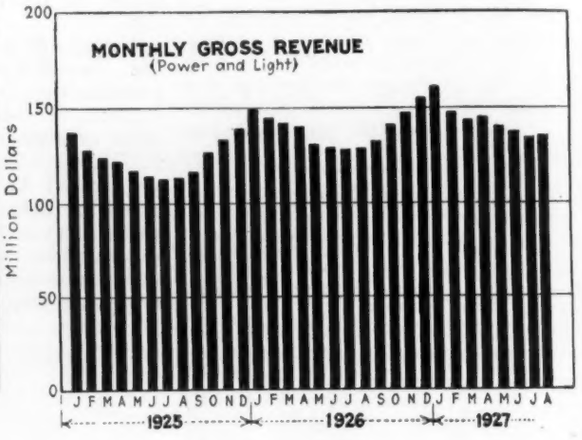


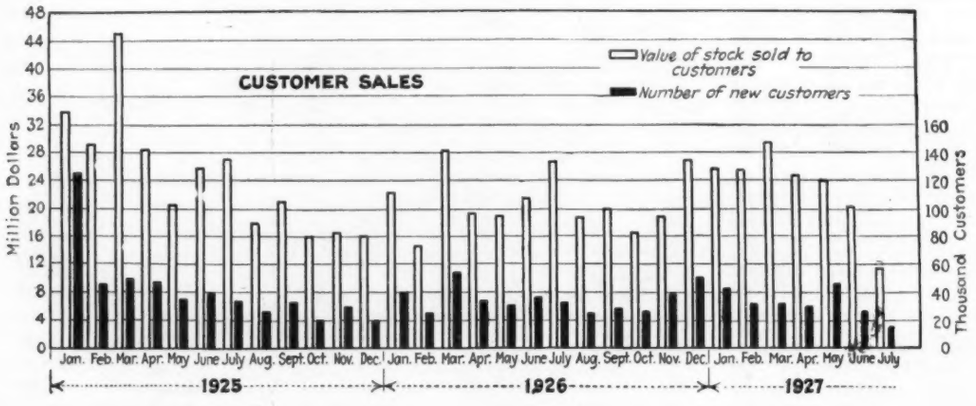
PORTION OF A BALANCE SHEET BROADCAST BY TELEPHOTOGRAPHY

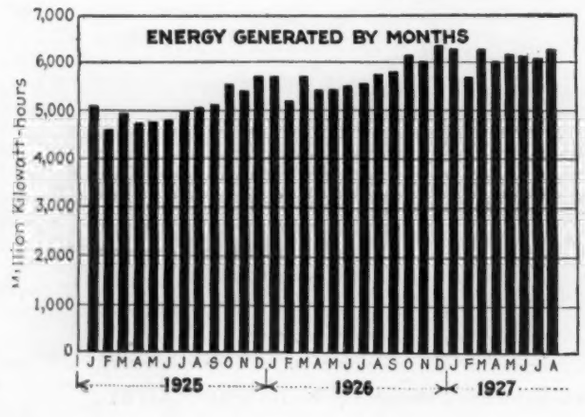
Monthly Index of Business Trends *in the* ELECTRICAL INDUSTRY

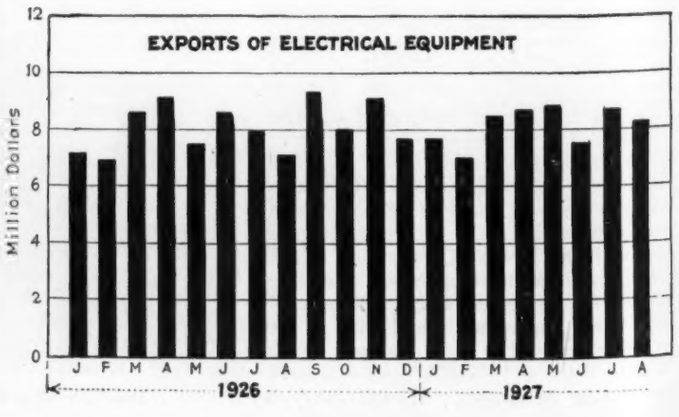



TOTAL MONTHLY FINANCING
(Power and Light)
Million Dollars
250
200
150
100
50
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S
1924
1925
1926
1927


MONTHLY GROSS REVENUE
(Power and Light)
Million Dollars
200
150
100
50
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A
1925
1926
1927




ENERGY GENERATED BY MONTHS
Million Kilowatt-hours
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A
1925
1926
1927



Rigid Internal Regulation of Practices Disarms Criticism*

By Henry R. Hayes
President Investment Bankers' Association of America

WHAT is needed above all else is regulation by state commissions which shall be uniform in all states, as well as broad in authority as to rates, valuations and services. In this connection we are in hearty accord with the work of a committee of the National Conference of Commissioners on Uniform State Laws. That committee, as you know, presented a draft of a uniform law for the regulation (by states) of utilities. That proposed act in final form will be considered at the 1928 conference of the commissioners. The Investment Bankers' Association of Americ- anticipates that the act in its final form will be fully acceptable to it, in which case that association will recommend that its members take an active part in favoring adoption of its principles by the various states.

The Investment Bankers' Association of America has many times actively opposed legislation which has appeared to it to be economically unsound or having for its purpose political supervision, interference or operation. The general record in this country and elsewhere cannot point to successful public ownership and operation of these public utilities. Too often do we learn of poor accounting methods and other unsound business practices. The public utility business is no activity in which the federal government or any of its political divisions should engage.

The difficulty in any study of public operation of utilities is to get facts. Too frequently this is due to a serious lack of sound accounting principles. A recent analysis of state laws discloses that many states exercise no control of any kind over the bookkeeping of publicly owned and operated properties. Members of this association, as distributors of both municipal and public service securities, have a keen interest in this subject. As investors in these two classes of securities, financial institutions such as insurance companies, savings and state and national banks really have a similar interest. How can taxpayers or holders of obligations of a municipality which operates a public utility get real information as to the value of a property unless sound accounting is practiced and the facts released?

Your business is one of the most important in the country. It has been guided by you with foresight and courage. You are to be especially commended for keeping down costs so as to sell better service at prices permitting increased consumption. Furthermore, the financial structures of your companies, generally speaking, have been materially improved. That is greatly to your credit. The industry as a whole desires, as we see it, to keep its business

*Excerpts from an address delivered at the annual convention of the American Gas Association, Chicago, Oct. 12, 1927.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday, Oct. 25	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	132½	83	141½
Adirondack Pwr. & Lt.—7% pf.	112	107	113½
Adirondack Pwr. & Lt.—8% pf.	114	112	116
Ala. Pwr., $7 cum. pf.—no par	112½	107	112½
Allis-Chalmers Mfg., 7% pf.	m111½	109	112½
Allis-Chalmers Mfg., 6% com.	114	88	118½
Aluminum Co. of Amer., com.	97	67½	105½
Aluminum Co. of Amer., 6% of	104	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	105	86½	108
Amer. & Foreign Pwr., com.—no par	25½	18½	30½
Amer. Bosch Magneto, com.—no par	22½	13	26½
Amer. Brown Boveri Elect.	k 9	5½	39½
Amer. Brown Boveri Elec., pf. $7	k 46	40	98
Amer. Gas & Elec., 6% pf.—no par	103	95½	105½
Amer. Gas & Elec., com.†—no par	109½	68½	117½
Amer. Lt. & Trac., 6% pf.	112	112	120
Amer. Lt. & Trac., new com.	k176	164½	186
Amer. Pwr. & Lt., 6% pf.	106	97½	107
Amer. Pwr. & Lt., com.†—no par	66½	54	73½
Amer. Pub. Serv., 7% pf.	a 99½	94	104
Amer. Pub. Serv., com.†	70	....	....
Amer. Pub. Utilities, 7% pfd.	a 90	73	90
Amer. Pub. Utilities, 7% pr. pf.	m 93½	92	96
Amer. Pub. Utilities, com.	k 57	65	70
Amer. States Sec., A	5	2½	4½
Amer. States Sec., B	5	2½	4½
Amer. Superpwr., 6% pfd.	29½	26½	29½
Amer. Superpwr., 6% 1st pf.	f 98½	....	....
Amer. Superpwr., Class A†—no par	k 38	27½	41½
Amer. Superpwr., Class B†—no par	39	28½	43
Amer. Wtr. Wks. & Elec. 7% pf.	m111½	104½	111
Amer. W. W. & E., com new—no par	64½	46	72½
Anaconda Copper cap. $3	46½	41½	49½
Appalachian Electric Pwr., 7% pf.	107	100	105
Appalachian Elec. Pwr., com.	m 78	77	83
Arizona Pwr., 7% pf.	k 85	77	88
Arizona Pwr., com.	m 20	....	....
Arkansas Pwr. & Lt. 7% pf.	106	....	....
Assoc. Gas & Elec., $3.50—50	51	....	....
Assoc. Gas & Elec., pf.—86—no par	93	85	93
Assoc. G. & E., Class A, 10—no par	43½	35	43½
BABCOCK & WILCOX, 7% com.	115	113	124
Binghamton L., H. & P., $6 pf.	98	93	100
Birmingham Elec., pf.—$7—no par	109	105	109
Blackstone Valley G. & E., 6% pf.	107	103	105
Blackstone Valley Gas & Elec., 10% com.—50	127½	98	154½
Blaw-Knox, com.†	f 85½	70	96½
Brazilian Trac., Lt. & pwr., com.†	f196	....	....
Broad River Pwr., 7% pf.	103	97	104½
Brooklyn Edison, 8% com.	178	148½	184½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 26	....	..
Buffalo, Niagara & East. Pwr. com. $1—no par	f 36	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f109½	107	109½
Central & S.W. Util., $7 pf.—no par	a 98½	92½	99
Central & S.W. Util., pr.ln.$7 pf.—no par	a102½	98½	104⅛
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	106	100	104
Central Ill. Pub. Serv., $6 pf.	a 92½	88½	95½
Central Ind. Pwr., 7% pf.	a 93½	85½	95
Central Pwr. & Lt., 7% pf.	101	100½	103
Central States Elec., 7% pf.	99½	92½	101
Central States Elec., com.†	k 29	17½	30½
Century Elec., 6% com.	m162	114	162
Chicago Fuse Mfg., com.—$2.50 no par	a 33½	30	35½
Cincinnati Gas & Elec., 5% com.	a100	96½	100½
Cities Service, $6 pf—no par	f 93½	87½	95
Cities Service, pf. B—no par	f 8½	7½	8½
Cities Service, pf. BB—no par	m 86	80	86
Cities Service, com.—20	f 50½	40½	58½
Cities Service, Bks. Shrs.—10	k 25½	22½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110½	108	112
Cleveland Elec. Illg., 10% com.	322	285	330
Columbia Gas & Elec., 6% pf.	107½	99½	108
Columbia G. & E. com. $5—no par	89½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	m 98	97	100
Columbus Elec. & Pwr., $2 com.—no par	68	67½	80
Columbus Ry., Pwr. & Lt., 6% 1st pf.	104½	98½	106
Columbus Ry., Pwr. & Lt., 6½% pf. B	103½	96	104
Columbus Ry., P. & L., com.—no par	102	75	105
Commonwealth Edison, 8% com.	a168½	138	171
Commonwealth Pwr., 6% pf.	101½	91½	103½
Commonw'th Pwr., $2, com.—no par	68½	48½	78½
Conn. Lt. & Pwr., 8% pf.	121	119	123
Conn. Lt. & Pwr., 7% pf.	117	112	118
Cons. Gas of N. Y., pf.	99½	93	100½
Cons. Gas of N. Y., com $5—no par	112½	94	121½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	k105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e113½	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e113	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e127½	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 69½	51	71
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	104	100	102
Consumers Pwr., 6.6% pf.	106	103	105½
Continental Gas & Elec., 8% pfd. pf.	108	103	106½
Continental Gas & Elec., 7% pr. pf.	104	100	103
Conti. G. & E. com. $4.40—no par	k250	210	225
Crocker Wheeler, com.†	23	27	38
Crocker Wheeler, 7% pf.	80	75	88
DALLAS PWR. & LT., 7% pf.	109	107	110½
Dayton Pwr. & Lt., 6% pf.	107	101	107
Detroit Edison, 8% com.	k158½	133½	160½
Dubilier Condenser, com.—no par	k 4	2½	5½
Duquesne Lt., 7% pf.	k116½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	107	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	11	9	13
Eastern States Pwr., pf.	95	90	95
East. Tex. Elec., 7% pf.	106	106	108
Edison Elec. of Boston, $12 com.	k250	217	267
El Paso Elec., 7% pf.	110	105	107½
Elec. Bond & Share, 6% pf.	f1C8½	105½	110½
Elec. Bd. & Sh. Sec., com. $1—no par	f 74½	67½	80½
Electric Household Util.†	a 12½	11	15½
Elec. Investors, 6% pf.—no par	98½	92	97
Elec. Investors, com.†—no par	40½	32½	42½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	k105½	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	k118½	103½	119
Elec. Pwr. & Lt., ctfs. full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	27½	16½	29½
Elec. Refrig. cap.†	10½	9½	37½
Elec. Ry. Securities, com.—no par	6	....	....
Elec. St. Battery com. $5.25—no par	71½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	103	99	101½
Emerson Elec., pf.	m109	107½	111
Empire Pwr., ptc.†	32½	26	39
Engr. Pub. Serv., $7 pf.—no par	m107½	93½	108
Engr. Pub. Serv., com.—no par	36½	21½	39½
Eureka Vacuum Cleaner, com. $4—no par	71½	50	77
FAIRBANKS MORSE, 7% pf.	k100	107½	112
F.-M., com.—$3—no par	k 35½	32	43½
Federal Lt. & Trac., com. $1.40	39½	37½	47
Federal Lt. & Trac., $6 pf.—no par	k 98½	91½	100
Ft. Worth Pwr. & Lt., 7% pf.	f111	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	78½	68	72
Galveston-Houston Elec., com.	35	26	32
Gen Elec., $3 com.—no par	127½	81	146½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	37	34	47½
Gen. G.&E. (Del.) com. B—no par	m 45	35½	44
Gen. G.&E. (Del.) pf. A. $8—no par	k118½	113½	120
Gen. G.&E. (Del.) pf. A $7—no par	k110	100	110½
Gen G.& E. (Del.) pf. B $7	k104	96	105
Gen. Pub. Serv., $7 cum. pf., no par	k113½	105½	113½
Gen. Pub. Serv., com., no par	16½	11½	18
Ga. Lt., Pwr. & Rys., 6% pf.	93	87	96
Ga. Lt., Pwr., & Rys., com.	m 50	50	80
Ga. Ry. & Pwr., 8% pf.	k125	119	125
Ga. Ry. & Pwr., 7% pf.	k113½	106	110
Gt. Western Pwr., 7% pf.	k102	....	..
IDAHO PWR., 7% pf.	106	103	109
Ill. No. Utilities, 6% pf.	k 96	88	97
Ill. Pwr. & Lt., 7% pf.	101½	90	96½
Ingersoll Rand com. $8	k 87½	87½	96½
Int. Combus. Engr., com. $2—no par	44½	42½	64
Int. Util., Class A—$3.50—no par	45½	28	47½
Int. Utilities, Class B—no par	9	3	9½
Interstate Pwr., pf.—$7—no par	96½	93	98
Interstate Pub. Serv., 7% pf.	100	98	99½
Iowa Ry. & Lt., 7% pf.	97	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	104½	97½	105
Johns-Manville, com.†—no par	119½	55½	123½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Oct. 22. lBid price Wednesday, Oct. 26. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday, Oct. 25	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	115¼	112	116
Kansas Gas & Elec., 7% pf.	*l*107	103	107
Kentucky Hydro-Elec., 7% pf.	*a* 99½	94¼	100
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	109	110	115
Kentucky Utilities, 6% pf.	100	95	101
Keystone Pwr. & Lt., pf.	*m*98	95	100
LACLEDE GAS LT., 12% com.	*k*205	173¼	267½
Lehigh Pwr. Sec., com.—no par.	20	15	21¼
Long Island Ltg., 7% pf.	110	107½	114
Long Island Ltg., com.†—no par.	163	139	180
Los Angeles Gas & Elec., 6% pf.	103	98	104½
Louisville Gas & Elec., cl. A. $1.75	26½	23¼	27¼
MAN. ELEC. SUPPLY, cap. $5 —no par	46¼	43	132
Manila Elec., com.†—no par	59	40	60
Maytag Mfg., com. .50—no par	31¼	23¼	34½
Memphis P. & L., pf.—$7—no par	109½	107	109
Metropolitan Ed., pf.—$6—no par.	102¼	93	100
Metropolitan Ed., pf.—$7—no par.	108	104	108
Metropolitan Ed., com. $5—no par.	75	60	72
Middle West Utilities, 7% pf.	*a*114¼	110½	113½
Middle West Util., 8% pr. lien	*a*124	117½	124
Middle West Util., com. $6—no par	*a*113½	108	117½
Midland Utilities, pr. in. 7% pf.	*a*104½	97½	107½
Midland Utilities, 7% pf. A	*a* 91½	91	92½
Milwaukee Elec. Ry. & Lt., 7% pf.	*k*102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	*k* 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	*l*107	104	107
Miss. Pwr. & Lt., $8 pf.	*m*101	106	103
Miss. River Pwr., 6% pf.	103	94	104½
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par	106	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par	110	98	112
Mohawk Hudson Pwr., com.—no par	29½	20½	32½
Montana Pwr., 7% pf.	*m*106½	118½	106½
Montana Pwr., 5% com.	104½	81½	109½
Montreal Pwr., 7% com.	*f* 89	....	....
Mountain States Pwr., 7% pf.	100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110
National Carbon, 8% pf.	*m*138	130½	139½
National Elec. Pwr., A†	*a* 27	22	28½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	107	101	110
National Pwr. & Lt., com.†—no par.	24	19½	26½
National Pub. Serv., 7% pf.	100½	93	100
National Pub. Serv., 7% pfc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par	22½	18½	24
National Pub. Serv., B com.—no par	*k* 21½	14	21½
Nebraska Pwr., 7% pf.	*l*110½	106	110
Nevada-Calif. Elec., com.	*k* 35	25	36½
New Brunswick Pwr., 4% pf.	60	....	....
New Eng. Pub. Serv., pr. in. pf. $7..	101	98½	102
New Eng. Pub. Serv., pf. $7.	98	95	99
New Orleans Pub. Serv.—7% pf.	103	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	91	97
N. Y. Central Elec., 7% pf.	102	101	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25....	*k* 29½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	53½	50	55
No. Amer., com.—10.	58½	45½	64½
No. Caro. Pub. Serv., pf.—$7—no par	102	93	102½
Northeastern Pwr., com.	22½	14½	22½
No. N. Y. Utilities, 7% pf.	106	103	109
No. Ohio Pwr., com.—no par.	16½	9½	18½
No. Ohio Trac. & Lt., 6% pf.	85	78	81
No. Ont. Lt. & Pwr., 6% pf.	*k* 91½	84	95
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr., (Del.) 7% pf.	107	100½	109½
No. States Pwr., (Del.) 8% com.	126½	109½	133
No. Texas Elec., 6% pf.	65	65	70
No. Texas Elec., com.	25½	27	36
OHIO BRASS, com. B $4—no par.	95½	76	98
Ohio Brass, 6% pf.	105½	100	107
Ohio Pwr., 6% pf.	103	96	103
Ohio Pub. Serv., $6 pf.	98½	95	96½
Ohio Pub. Serv., 7% pf.	109	103	109
Ohio River Edison, 7% pf.	108	103	109½
Oklahoma Gas & Elec., 7% pf.	102½	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	42	31	45½
Pacific Pwr. & Lt., 7% pf.	*l*104½	102	104½
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 80	75½	80
Penn-Ohio Edison, 7% pf.	103½	97½	104½
Penn-Ohio Elec., 7% pf.	*m*102	99	103
Penn-Ohio Pwr. & Lt., 7% pf.	102	99	110
Penn Pwr.& Lt.—$7—no par.	*l*109½	107	109
Penn Wtr. & Pwr., 8% com., new	*e* 68½	47½	73½
Phila. Co., 6% pf.—50.	*c* 53	49½	54
Phila. Co., com.—50.	125	85½	128½
Phila. Elec., 8% com.—25.	*c* 53½	46½	58½
Portland Elec. Pwr., 7% pf.	100	97½	101
Portland Elec. Pwr., 6% pf.	80	78	83
Portland Elec. Pwr., 6% 2d pf.	65	55	70
Portland Elec. Pwr., com.	30	22	30
Potomac Elec. Pwr., 6% pf.	*j*111½	....	....
Pwr. Corp. of N. Y., com. $1—no par	*m* 79	....	....
Pwr. Sec., pf.—no par.	*k* 43	28	45
Pwr. Sec., com.—no par.	*k* 12	5	15
Public Serv. of Colorado, 7% pf.	*l*103	....	....
Pub. Serv. of N. J., 6% pf.	*l*102	98½	102½
Pub. Serv. of N. J., 8% pf.	*k*132	125	133
P. S. of N. J., $2 com.—no par.	42	32	46½
Pub. Serv. of No. Ill., 6% pf.	*a*107½	101½	107
Pub. Serv. of No. Ill., 7% pf.	*a*116½	112	117½
P. S. of No. Ill., com. $8—no par.	*a*161½	140½	161½
Pub. Serv. of No. Ill., $8 com.	*a*161½	132	161½
Pub. Serv. of Okla., 7% pr. in.	*k*101	90	103
Pub. Serv. Elec. & Gas, 6% pf.	*k*108½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	106½	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par.	88	....	....
Puget Sound Pwr. & Lt., com.	35½	28	38½
RADIO CORP. OF AMER., $3.50 pf.—50	*k* 54½	49	54½
Radio Corp. of Amer., com.—no par.	75½	41½	75½
Republic Ry. & Lt., pf.	*m*120	....	....
Republic Ry. & Lt., com.	*m*135	112	135
Rochester Gas & Elec. 6% pf. D.	104½	101	103½
Rochester Gas & Elec., 7% pf. B.	104	105	107
Rochester Gas & Elec., 6% pf. C.	104½	101½	103½
SAFETY CABLE, com. $4.	67½	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	72	70	73
Servel Corp.	12cts	12cts	10½
Sierra Pacific Elec., 2% com.	29½	24½	31½
Sioux City Gas & Elec., 7% pf.	104½	99	105½
Southeastern Pwr. & Lt., pf.—$7 no par	*l*107½	....	....
Southeastern Pwr.& Lt.,pfc.pf.	*l* 82½	....	....
Southeastern Pwr. & Lt., com.—no par.	37½	29½	40
So. Calif. Edison, 8% pf.	39	36½	40
So. Calif. Edison, 7% pf.	*k* 28	27½	28½
So. Calif. Edison, 6% pf.	26	24½	26
So. Calif. Edison, 8% com.	39	31½	41
Southern Cities Utilities, 7% pf.	*k* 80	67	90½
Southern Cities Utilities, com. $4.	32½	31	42½
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	86	83	91½
Southwestern Pwr. & Lt., 7% pf.	*k*109	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	*k*102	95	102
Standard Gas & Elec., 8% pf.	64½	57½	65½
Standard Gas & Elec., 7% pr. pf.	110½	103	112
Standard G. & E., com. $3.50—no par	60½	54	65½
Standard Pwr. & Lt., 7% pf.	100½	98½	102
Staten Island Edison, pf.—$6—no par	101½	99	101
Superheater, $6 com.—no par.	176	170	185
Syracuse Lighting, 7% pf.	110	103	107
Syracuse Lighting, 8% pf.	117½	....	....
Syracuse Lighting, 8% com.—no par	*m*300	....	....
TAMPA ELEC., com. $2.	63	49	64½
Tenn. Elec. Pwr., 6% pf.	100	92	100
Tenn. Elec. Pwr., 7% pf.	108	103	109
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	30
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	*l*111½	106	111½
Tide Water Pwr., 8% pf.	109	105	110
Timken Roller Bear., com.—$4 no par	116	78	142½
Toledo Edison, 8% pf.	*m*114	115	118
Toledo Edison, 7% pf.	*l*107	....	....
Toledo Edison, 6% pf.	*k* 98½	95	97
Toledo Edison, 6% com.	98	....	....
Tri-City Ry. & Lt., 6% pf.	96½	96	99
UNITED GAS & ELEC., 6% pf.	101	98	102
United Gas & Elec., com.—no par.	*m* 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50.	*c* 108	89½	118½
United Lt. & Pwr., pf.—$4—no par.	*a* 54½	50	57
United Lt. & Pwr., pf.—$6.50—no par.	*a* 95½	87	97½
United L. & P., com. A .48—no par.	14½	12½	15½
United L. & P., com. B .48—no par.	19½	16	19½
Utah Pwr. & Lt., 7% pf.	*l*107½	104	108½
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	96½	93	100
Utilities Pwr. & Lt., com. A $2.	30½	27	34
Utilities Pwr. & Lt., com. B $1—no par.	23½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	99	95	100
Virginia Elec. & Pwr., 7% pf.	108	105	110
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	75	....	....
WAGNER ELEC., 7% pf.	*b* 86½	68	90
Wagner Elec., com.—no par.	*b* 29	18½	39½
Washington Ry. & Elec., 5% com.	*j*375	....	....
Washington Ry.& Elec.,5% pf.	*j* 99½	....	....
Washington Wtr. Pwr., 8% com.	164	136	182
West Penn Elec., 7% pf.	110½	102	112½
West Penn Elec., Cl. A $7.	105½	97½	110
West Penn Pwr., 7% pf.	115½	111	118
West Penn Pwr., 6% pf.	107	100½	108½
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
West Va. Utilities, 7% pf.—50.	*m* 90	48	51½
Western Pwr., 7% pf.	*k*103	98	101½
Western States Gas & Elec., 7% pf.	*k*103	96	105
Western States Gas & Elec., com.	*m* 38	....	..
Westinghouse Elec. & Mfg., 8% com. —50.	80½	67½	89½
Weston Elec. Instrument, Cl. A $2 —no par ex.div.	*k* 30½	30	34½
Weston Elec. Instrument, com.—no par.	*k* 11½	11	18½
Wheeling Elec., 6% pf.	102	95	104
Worthington Pump, 7% pf. A.	*k* 45	46	61½
Worthington Pump, 6% B.	*k* 37½	37	54½
Worthington Pump, com.	*k* 26½	20½	46
YALE & TOWNE com. $5—25.	79½	70½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Oct. 22. *l*Bid price Wednesday, Oct. 26. *m*Latest quotations available. †Dividend rate variable.

clean, expand its service and to develop the arts and sciences for improved service. If, owing to too rapid expansion or for other reasons, financial or managerial, mistakes have been made, let us have each situation examined separately so that we may profit thereby.

In closing, and along these lines, I desire to quote from the annual reports of the committee on public service securities which was submitted at the sixteenth annual convention of the Investment Bankers' Association, Sept. 29, 1927:

Recommendations Made by Bankers

"In connection with alleged abuses of capitalization, your committee makes the comment that while obviously it can be argued in reply to criticism that the marshaling of figures and statistics to prove a general proposition may work injustice in particular cases, the fact remains that the matter of capitalization of public utility properties is receiving legislative and public attention. Recognizing that the investment banker is in a position to judge concerning the merits surrounding individual cases and is able to exercise in some of such cases a determining influence in matters of capitalization, we recommend that all members of this association use such influence as they may exert in the interest of conservative finance.

"Regulation of practices of any industry which proceeds from thoroughly informed sources either within or associated with the industry itself is to be preferred over one imposed by governmental authority which experience has shown to be uneconomical in many respects. However, unless such inner regulation of practice prevents flagrant abuses, there is always the danger of agitation for government supervision. While any such agitation might result from and be directed at the abuses in particular cases, it could hardly help affecting, in a measure at least, the soundly conceived enterprises in the industry and the thousands of investors, many of them people of small means, who have invested in their securities. It is, therefore, to the interest not only of the leaders in the public utility industry itself, but also to the bankers who sell their securities, to direct all possible influence for removing or preventing any just cause for criticism."

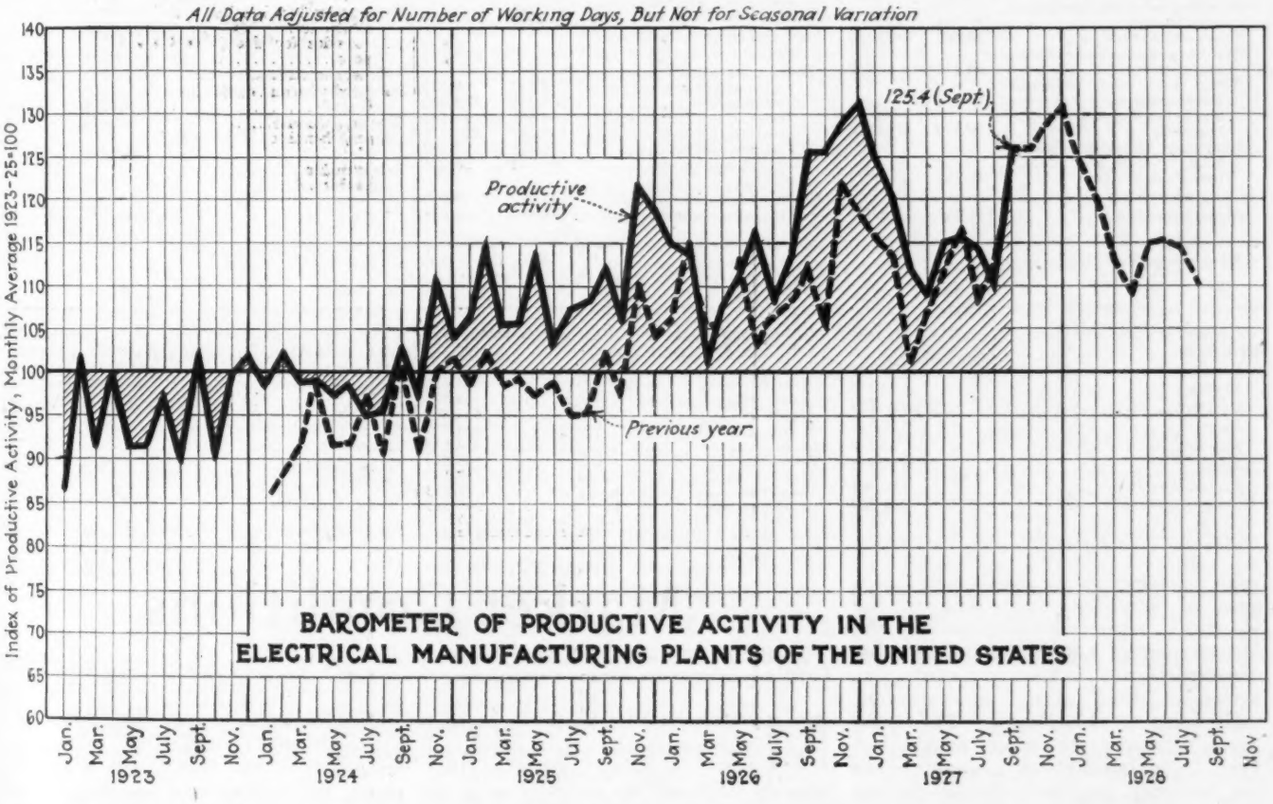
Connecticut Company Files Stock Increase Notice.—The Connecticut Power Company, Hartford, Conn., has filed notice of an increase in capital stock from $6,250,000 to $7,550,000. This change in set-up was approved at a recent meeting of the stockholders.

Business News and Market Conditions

Productive Activity Same as Last Year

Electrical Manufacturing Plants Increase Operations by 13.8 Per Cent During September—Aggregate Production in Current Year Should Exceed 1926

AS WAS to be expected, the month of September witnessed a material increase in the productive activity of the electrical manufacturing plants of the nation. Reports on electrical energy consumption made to the ELECTRICAL WORLD by these plants indicate that September activity was 13.8 per cent over that during August and that the rate of activity during September was virtually the same as that reported for September last year but was 11.7 per cent over the productive activity wit-



nessed during September, 1925. It would appear that while the electrical manufacturing plants were operating during the first half of the year materially above the operations reported for the same period last year, the rate of activity during the second half of the current year will probably be about the same as if not slightly under that of the same period last year. It seems probable, however, that the current year as a whole will witness an aggregate production of electric supplies and equipment slightly exceeding that of 1926. The smaller manufacturers taken as a group reported a September activity 15.0 per cent over that of August, while the large manufacturers taken as a group reported an 11.3 per cent increase in activities.

The index of activity in the electrical manufacturing industry based on electrical energy consumption stands at 125.4 for September as compared with 110.2 for August, after adjustments are made for the number of working days in the two months. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100, and adjusted for number of working days, are as follows:

September, 1927	125.4
August, 1927	110.2
July, 1927	114.5
September, 1926	125.6
September, 1925	112.3
Average for first six months of 1927	116.2
Average for full year 1926	116.6

The increase in activities during September by the electrical manufacturing plants was considerably greater than the increase in activities reported by general industry in the nation as a whole. Both general industry and the electrical manufacturing industry, however, were operating at virtually the same level as September last year.

Imports of Carbon-Filament Lamps Decrease

The German exportation of carbon-filament lamps, the principal part of which goes to the United States, shows a very large decrease.

From 6,760,000 lamps in 1927, exportation in the first half of the current year has fallen to 710,000 lamps.

At the same time, the sale of German metal-filament lamps has also decreased somewhat in the United States, although the American market does not play any great rôle in the German exportation of metal filament lamps. The total exportation of metal-filament lamps decreased from 55,880,000 lamps in 1925 to 48,800,000 lamps in 1926; but there is shown an increase in the first half of this year to 18,830,000 lamps as compared with 16,470,000 lamps in a similar period last year.

Electrical Exports Continue to Increase

Exports of electrical equipment from the United States for the eight months ended Aug. 31 showed a considerable increase over the same period last

Value and Destination of Electrical Exports for August, 1927, Compared with Corresponding Month in 1926

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	August 1926	August 1927
Generators:		
Direct-current:		
Under 500 kw.	$93,710	$71,275
500 kw. and over	93,237	49,589
Alternating current:		
Under 2,000 kva.	12,525	13,020
2,000 kva. and over	8,080	.....
Steam turbo-generator sets	12,941	19,531
Accessories and parts for generators	40,330	112,358
Self-contained lighting outfits	110,705	148,314
Batteries:		
Flashlight batteries	90,382	172,750
Other primary batteries	172,191	195,029
Storage batteries	200,645	306,815
Transforming or converting apparatus:		
Power transformers	121,496	152,675
Other transformers	150,449	71,235
Rectifiers, double - current and motor-generators, dynamotors, synchronous and other converters	51,100	253,074
Transmission and distribution apparatus:		
Switchboard panels, except telephone	81,332	118,461
Switches and circuit breakers over 10 amp.	229,753	145,697
Fuses and fuse blocks	24,603	28,689
Watt-hour and other measuring meters	35,111	47,652
Volt, watt and ampere meters and other recording, indicating and testing apparatus	158,350	176,860
Lightning arresters, choke coils, reactors and other protective devices	70,161	77,972
Motors, starters and controllers:		
Motors under 1 hp	141,237	266,445
Stationary motors:		
1 to 200 hp	206,559	292,844
Over 200 hp	16,865	15,102
Railway motors	99,833	89,598
Electric locomotives:		
Railway	42,000	.....
Mining and industrial	40,144	11,203
Starting and controlling equipment for electric railway and vehicle motors	53,200	6,711
Industrial motors	87,035	69,199
Portable electric tools	42,750	75,972
Accessories and parts for motors	184,343	234,575
Electric appliances:		
Electric fans	79,894	86,102
Electric lamps:		
Metal filament	129,836	82,679
Other electric lamps	18,231	45,256
Flashlights	122,341	223,248
Searchlights and projectors	28,085	50,184
Motor-driven household devices	123,313	169,201
Domestic heating and cooking devices	100,975	140,247
Industrial electric furnaces and ovens	28,743	75,124
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	113,030	125,684
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	24,182	9,742
Receiving sets	303,732	183,402
Tubes	81,698	79,467
Receiving set components	159,097	202,010
Receiving set accessories	206,423	219,397
Telegraph apparatus	128,124	55,271
Telephone apparatus:		
Telephone instruments	35,202	29,773
Telephone switchboards	214,894	32,051
Other telephone equipment	146,317	276,304
Railway signals, switches and attachments	44,058	36,330
Bells, buzzers, annunciators and alarms	17,648	18,325
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	97,890	138,238
Insulating material	82,232	130,702
Metal conduit, outlet and switch boxes	64,050	103,628
Sockets, receptacles and lighting switches	135,275	150,997
Electric lighting fixtures, interior and street	143,116	187,190
Other wiring supplies and line materials	78,800	102,027
Other electrical apparatus, not elsewhere stated	582,484	509,770
Rubber and friction tape	34,069	37,847
Globes and shades for lighting fixtures	43,949	43,055
Electrical glassware except for lighting	30,034	17,718
Electrical porcelain:		
For less than 6,600 volts	44,638	28,674
For 6,600 volts and over	102,386	35,084
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	83,708	154,867
Other carbon products	117,001	111,639
Insulated wire and cable (iron and steel)	40,970	30,422
Copper, bare wire	151,794	141,681
Copper, insulated wire and cable	417,476	431,787
Refrigeration sets up to 1-ton capacity	*	421,475
Total	$7,026,762	$8,139,241

*Not collected in 1926.

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	August, 1927
EUROPE	$1,432,896
Belgium	78,443
France	90,158
Germany	140,831
Italy	107,997
Netherlands	78,606
Spain	122,492
United Kingdom	546,167
Other countries	268,202
WESTERN HEMISPHERE	$4,507,166
Canada	1,616,624
Mexico	444,609
Cuba	359,978
Argentina	531,006
Brazil	461,737
Chile	424,640
Colombia	103,911
Peru	140,139
Venezuela	74,953
Other countries	349,569
ASIA, AFRICA AND OCEANIA	$2,199,239
British India	173,747
China	114,341
Japan	402,870
Philippine Islands	146,745
Australia	824,051
New Zealand	135,030
British South Africa	121,955
Other countries	280,500

year, amounting to $65,145,935, or a gain of $2,107,243, according to the electrical equipment division of the Department of Commerce. The value of exports in August shipments, as shown in detail in the accompanying table, was $8,139,241, or $1,111,479 more than for the same month last year. The outstanding increases were for batteries, rectifiers, double-current and motor-generators, dynamotors, synchronous and other converters, motors under 1 hp., and electric lamps. Decreases were noted for radio apparatus with the exception of receiving set components and accessories, telegraph apparatus, starting and controlling equipment for electric railway and vehicle motors, and switches and circuit breakers over 10 amp. Declines were also registered for heavy electrical equipment. Although exports of motors under 1 hp. registered an increase of $125,208 for the month of August as compared with the same month last year, shipments for that month were $45,224 less than for the preceding month of this year.

Market Conditions

MANUFACTURERS report that business is on a good level and there is every indication that sales in 1927 will be virtually equal to those of 1926. Automobile manufacturers have been fairly large purchasers and some good orders have been placed by cement mills. The Southeast and the Northwest stand out as the brightest localities for purchasing during the past week, though Missouri and Texas have some construction projects pending. Central-station purchases of switching, high-tension transformers and line materials are prominent in the Southeast, where textile and ice plants are also active. Commercial and school lighting figure conspicuously around Atlanta. In the Northwest three lumber mills placed substantial orders for motors and control apparatus. Seattle has approved a four-year budget of $8,000,000 for hydro-electric construction. Along the remainder of the Pacific Coast cement, paper, oil, lumber and smelting industries have placed orders for equipment. School, street, college and dry-goods building lighting figure among the activities. Around St. Louis the sale of stock motors and transformers is about normal. An industrial order for $15,000 worth of pumps and control and sale of $7,500 worth of pumping equipment to the Illinois drainage district figure most prominently. Elsewhere in the country business is rather quiet, buying of 1-hp. to 10-hp. motors by industrial companies dominating the purchases in New England and the Middle Atlantic States. Several annealing furnaces have been sold in New England. Inquiries are very light around New York. In the

Middle West there is a gradual, but not marked, improvement in sales, purchases being chiefly for substation and switching equipment.

Quiet Week Experienced in Metal Markets

The extreme activity in buying of copper and lead apparently ran its course last week, and the week ended Oct. 26 was a quiet one in the nonferrous metal markets. Buying of copper has been particularly dull, but there was a little more activity in zinc. Prices have tended toward lower levels, zinc suffering particularly in this respect. The Aluminum Company of America on Oct. 20 reduced its price on various grades by 1 cent per pound.

The copper market has again relapsed into a condition of stagnation such as existed prior to the wave of buying. As before, the leading producers are almost uniformly holding at 13.25 cents, at which level only scattering sales have been made in small tonnages. Organization of the General Cable Corporation is not expected to have any immediate effect on the copper market.

NEW YORK METAL MARKET PRICES

	Oct. 19, 1927 Cents per Pound	Oct. 26, 1927 Cents per Pound
Copper, electrolytic	13	13¼ to 13.2
Lead, Am. S. & R. price	6¼	6¼
Antimony	11¼	11
Nickel, ingot	35	35
Zinc spots	6.35	6.25
Tin, Straits	58¼	58⅛
Aluminum, 99 per cent.	26	25

Base copper price Oct. 26, 1927, 15¼ cents.

The continued weakening in the London lead market, which culminated Oct. 25 in a spot quotation of only £20 2s. 6d., put a quietus on buying in the United States, consumers evidently thinking that a reduction in prices was in order. Middle Western producers did go back to 6 cents, St. Louis, but the American Smelting & Refining Company continued its contract price in New York at 6¼ cents, though only an occasional carload was sold in the East on that basis outside of contract requirements. Lead might have been obtained from at least one seller at concessions of as much as ten points from that quotation in the last two or three days, if any one had shown an interest in buying a good lot.

Eastern Buying Quiet Except for Industrial Motors

Central-station buying in the New York district is quiet, and the inquiries received do not forcast any great increase in activity in the immediate future. Some manufacturers report a fairly steady volume of small orders, whereas others indicate a falling off of sales this month. Transformers and switching equipments are slower this week, and there is not much change in other lines. There is some improvement in the demand for motors by industrial buyers, particularly in sizes from 1 hp. to 10 hp. Makers of refrigerators, shoe machines and oil burners are active buyers, but individual orders are generally small and marked for immediate delivery. The market for conduit and general wiring supplies is quiet, but jobbers are finding a fair demand for appliances.

Construction projects planned in the territory include the following: The New York Central Railroad Company, New York, is asking bids until Nov. 4 for one 2,500-kw. synchronous converter and for three single-phase, 920-kva. air-blast transformers, with substation wiring, etc. The Harrisburg (Pa.) Light & Power Company plans the construction of transmission lines from city limits to the Pine Grove station of the Pennsylvania Power & Light Company.

Increasing Activity in Southeast

The excellent agricultural conditions, together with satisfactory prices for farm products, are beginning to be reflected in increasing activities in electrical lines throughout the Southeast. The central-station group is quite active, orders for the past week for switching equipment and high-tension transformers being reasonably fair. Two orders in this line amounted to $33,000. Inquiries are also very good on substation equipment and on line-material equipment, there being in the immediate future prospects for construction of approximately 150 miles of 44,000-volt transmission line. There are also in hand inquiries on steam turbo-generator equipment, one job for apparatus rated at 10,000-kw., having a prospect of materializing in the near future.

Industrial activities are confined to a great extent to the textile field. The only order last week for motor equipment amounted to $9,000, but several other very satisfactory orders are in prospect. Considerable interest is being displayed by ice plants in the electrification of mechanically driven plants, and prospects for orders are good. Throughout Georgia excellent sales on commercial lighting fixtures are reported. Lamp sales due to campaigns are exceeding early estimates. Equipment of the Atlanta aviation field with beacon lighting resulted last week in an order being placed for $13,000 worth of this class of equipment. Local contracting interests are quiet, though the letting of electrical contracts approximating $45,000 for five large public school buildings in Atlanta next week is expected to result in good orders for construction material. All interests report a most excellent business outlook for the remainder of the fall, and a spirit of optimism is reflected generally by the trade.

Construction projects reported for the territory are as follows: The Columbus (Ga.) Electric & Power Company, Columbus, has approved plans for a hydro-electric generating plant at Bartlett's Ferry, to cost about $750,000. Extensions will be made in transmission lines. The Southern Public Utilities Company, Charlotte, N. C., will enlarge and improve the power plant at Conover, N. C. It will build a local substation and make extensions in transmission lines and distributing system. The Richmond, Va., Cold Storage Company, Richmond, has plans for a one-story ice-manufacturing plant to cost approximately $135,000. The Monongahela-West Penn Public Service Company, Fairmont, W. Va., contemplates the construction of a power plant on a site secured on the Parkersburg-Elizabeth highway, near Elizabeth, W. Va., to cost about $75,000.

Small-Motor Sales Dominate New England Buying

Small-motor sales, limited in general to single and small-lot orders, gained during the past week. As reported by one manufacturer, conditions a little better than normal were attained with receipts over $50,000. Demands for heavy power equipment, on the other hand, were few and no large orders are reported. Central-station supplies and equipment continue to move fairly well, and several small lots, consisting of outdoor control apparatus, were placed. Electric heating furnaces are in active demand. A number have been recently placed in Massachusetts for annealing purposes, and two for a prominent Worcester wire-manufacturing plant are also of interest. Appliance sales are steady. Jobbers report spotty trade, new construction needs being well taken care of for this season. A survey of opinion indicates that the remainder of this year is very likely to uphold the level of last year in this district.

The Connecticut Light & Power Company has filed plans for the construction of a one-story substation at Meriden.

Construction Pending in Missouri and Texas

Conditions in the electrical industry have remained virtually the same in the territory surrounding St. Louis as reported last week. One fair-sized order was placed by a St. Louis industrial concern for motors and control apparatus, amounting to something over $15,000. Another was for motors to drive centrifugal pumps for one of the Illinois drainage districts, costing $7,500. Manufacturersr report sales of stock-size motors and transformers to be about normal. So far the month of October has been the best of the year for the electrical sign makers. Sales of building construction material for new and reconditioned jobs have been slightly above those of last year.

Construction plans in the Southwest include the following: The Missouri Public Service Company, will spend over $400,000 in plant improvements at Clinton, Mo. The Texas-Louisiana Power Company is planning the erection of a power plant at Texas City, Tex., to cost $400,000. The Central Power & Light Company will erect a cold-storage plant at Donna, Tex., and an ice plant at Beeville, Tex., which will cost approximately $100,000. Another at Sinton, Tex., will be about the same

size. The city of Dallas has appropriated $8,000,000 for waterworks improvements, $600,000 of which will be spent on a pumping plant. Rumors current in St. Louis building circles link the name of Preston J. Bradshaw with a new 23-story hotel to be erected at Twelfth and Olive Streets.

The Gulf States Utilities Company, Lake Charles, La., is planning construction of an ice-manufacturing plant, estimated to cost $150,000. The Texas-Louisiana Power Company, Fort Worth, Tex., is preparing for a small one-story power plant at Nocona, and will make extensions in transmission lines.

Diversified Industrial Sales on Pacific Coast

Good business from varied industrial plants featured the past week on the Pacific Coast. Orders included one 125-hp. motor for construction, a 100-hp. unit for a cement plant, a 3,000-kw. turbine for a paper mill, a 200-kva. transformer and three 200-hp. motors for two oil companies, and a 150-hp. motor for a lumber company. A smelting company wishes about $2,000 worth of line material for its local power extension. Power-company inquiries have included a seventeen-thousand-dollar switchboard and 20,000 pole steps and 30-in. braces. Miscellaneous orders of interest include four heavy-duty ranges and a 9-kw. griddle for a veterans' home, 300 lighting units for a state school and 88 street-lighting units for Sacramento. A carload of conduit and 2,000 boxes have been bought for the new St. Mary's College in Oakland. Three carloads of conduit, one carload of wire, 500 floor boxes and 2,000 convenience outlets will be needed for a new dry-goods building in San Francisco. Construction projects include the following: The Salt River Valley Water Users' Association will take bids early in January, for a new transmission line, to cost about $850,000. The City Council, Huntington Beach, Cal., will ask new bids for an ornamental lighting system on Main Street.

Lumber Mills Active and Seattle Plans Construction

Buying of electrical motors and apparatus, which has been light for several weeks in the Northwest, showed decided improvement last week. Three lumber mills placed orders which included 75 motors from 200 hp. down, a 250-kva. belted generator and 200 hp. in motors, switchboards and control apparatus, one 250-hp. motor and six units ranging from 25 hp. down. Other sales included 23 motors from 25 hp. down, one-third going to lumber mills, one-third to dealers and one-third to miscellaneous sources. The sale of motors to a rock-crushing plant is also reported.

Plans of Seattle's municipal lighting department for the expenditure of $8,500,000 during the next four years on the Skagit River hydro-electric development, have been approved. Bids will be asked within two weeks' time for a 14,000-kva. generator set, with 15,000 kva. in transformers, oil switches, switchboards, etc., for the Cedar Falls hydro-electric plant.

Reports have been received that the Salmon River Development Company, Washtucna, Wash., plans the construction of a hydro-electric generating plant on Slate Creek, near Grangeville, Ore., with transmission line, to cost about $200,000. The City Council, Morton, Wash., has voted bonds for $40,000 to expand its electric service system.

Middle West Utilities Buying Substation Equipment

General business in the Middle West continued about the same this week; it is gradually increasing, although not to a marked extent. Fall activity in industrial field is becoming more noticeable, and optimism is prevalent most everywhere. Utility companies are busy with construction work, considerable purchasing of apparatus going on. Among the interesting orders this week were those for 39 73-kv. disconnecting switches, of which 18 were rated at 600 amp.; 162 15-kv. disconnecting switches, of which 63 were rated at 3,000 amp.; two 80-ton electric locomotives, eight carloads of copper busbar and "Mazda" lamps valued at $250,000. Jobbers' sales show a gradual increase. Appliances are moving in good volume, particularly waffle irons, toasters and flatirons, Radiant heaters are selling readily and a considerable volume of business is being transacted in ventilating equipment. Prices remain generally firm. The price of two-conductor No. 14 "BX" cable was reduced 50 cents per 1,000 ft. in the week. Several 900-hp. motors and other equipment were recently purchased by a cement company in Wisconsin.

Among construction projects reported are the following: The Central States Electric Company, Cedar Rapids, Iowa, has surveys under way for a power dam at Memorial Park on the Des Moines River, near Kalo. The Central Power Company is having plans prepared for the construction of an addition to the power plant at Grand Island, Neb., to cost approximately $28,000. The City Ice & Fuel Company, Cleveland, is having plans prepared for a ten-story ice-manufacturing and cold-storage plant on Orange Avenue, to cost in excess of $1,500,000. The Wisconsin Power & Light Company, Madison, Wis., is planning a new transmission line.

Activities of the Trade

Fulton Iron Works Acquires Foos Engine Company

A substantial stock interest in the Foos Engine Company, Springfield, Ohio, has been acquired by the Fulton Iron Works Company, St. Louis. H. J. Steinbreder, president of the Fulton Iron Works Company, is now chairman of the board of the Foos Engine Company. The company states that this arrangement permits the handling by the Fulton sales organization, both domestic and foreign, of a complete line of Diesel engines, ranging in size from 10 hp. to 2,000 hp., for stationary, marine, dredge, power-boat, and portable uses, such as air compressors, shovels, drag lines, etc., and for locomotives and rail cars. The small engines will be manufactured in the Foos plant at Springfield, Ohio, and the large engines at the Fulton plant in St. Louis. Each company will retain its identity.

J. W. Marsh Will Probably Head General Cable

The General Cable Corporation, which is now in process of formation and details of which appeared in the Oct. 22 issue of the ELECTRICAL WORLD, will probably elect Joseph W. Marsh as chairman of the board of directors. Mr. Marsh is president of the Standard Underground Cable Company and is also president of the Exchange National Bank of Pittsburgh. It is reported that the fifty-million-dollar corporation will seek the listing of its securities on the New York Stock Exchange.

Allis-Chalmers Issues Nine Months' Earnings Statement

The comparative earnings statement of Allis-Chalmers Manufacturing Company, Inc., for the first three-quarters of 1927 has been issued, showing sales billed and net profits by quarters, also unfilled orders on hand at the end of the quarter.

Bookings for the first nine months of 1927 aggregated $23,521,893, compared with $25,670,191 for a like period in 1926, a decrease of 8.37 per cent. Unfilled orders on Sept. 30 amounted to

ALLIS-CHALMERS MANUFACTURING COMPANY QUARTERLY EARNINGS STATEMENT

	1927	
	Billing	*Net Profit
First quarter	$7,906,355	$850,163
Second quarter	8,666,874	831,987
Third quarter	8,479,653	776,709
	$25,052,882	$2,458,859

	1926	
	Billing	*Net Profit
First quarter	$7,328,018	$828,401
Second quarter	7,354,067	826,158
Third quarter	7,811,854	925,661
	$22,493,939	$2,580,220

* The net profits reported above are after provision for Federal income taxes and depreciation.

$11,182,568. Deducting from the 1927 earnings an item of $577,452, representing the two quarterly dividends paid on the preferred stock prior to its retirement on July 1, leaves a balance of $1,881,406 available for the common, which is equivalent to $7.26 per share compared with $6.65 per share for the same nine months' period in 1926.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, announces that F. T. Masterson, 2457 Woodward Avenue, Detroit, has taken over the agency for Packard transformers in the Michigan territory.

THE MARING WIRE COMPANY, Muskegon, Mich., manufacturer of magnet wire, announces that Thomas F. Kelly has been appointed sales manager. For the eight years prior to Jan. 1, 1927, Mr. Kelly was sales manager for the American Enameled Magnet Wire Company of Muskegon, Mich.

THE KELVINATOR CORPORATION, Detroit, has brought out a new line of colored, decorated refrigerating cabinets, the first four of which are now on display at its dealers' showrooms. They are available in cream, apple-green, turquoise-blue and Chinese-red finish.

THE GENERAL ELECTRIC COMPANY announces a new line of garage-type "Tungar" battery chargers, including two new chargers for heavy-duty work, a 15-battery and a 30-battery model which supersede the 10-battery and 20-battery types.

THE SPRAGUE ELECTRICAL SUPPLY COMPANY, Waterbury, Conn., has opened a branch office at 176 Federal Street, Boston. The sales personnel for the Boston office is G. F. Holland, manager, assisted by George Hutchings and W. H. Page.

THE REN MANUFACTURING COMPANY, 221 Main Street, Winchester, Mass., announces that a Ren lamp lock is now available for use with a composition weatherproof socket.

THE LINCOLN ELECTRIC COMPANY, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the appointment of E. A. Thornwell of Atlanta as its representative for Georgia and eastern Tennessee. John Van Horn, factory engineer for the Lincoln company, has been attached to the Atlanta office to assist Mr. Thornwell.

THE TRUMBULL-VANDERPOEL ELECTRIC MANUFACTURING COMPANY, Bantam, Conn., manufacturer of "TV" safety switches, announces the following changes in its personnel: Mark Carroll, who has been representing this company in the Connecticut territory, becomes sales engineer in the factory; Frank Bennett, who has been in the home office, will be connected with the Chicago office, and Neal Walsh, formerly with the A. R. McNally Company at Cleveland, has been appointed district sales manager for Ohio.

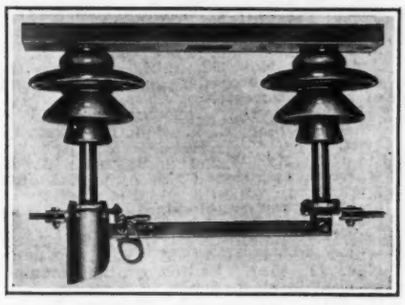
New Equipment Available

Lamp for Ornaments

A 10-watt, 115-volt "Mazda" lamp for use with light ornaments has been developed by the General Electric Company. The lamp uses the "S-11" bulb and is provided with an intermediate screw base. The lamp will be listed in clear, white, and the standard coated colors, namely, red, green, blue, yellow, amber, orange and flame-tint at 25 cents list, subject to large lamp discounts. The designed life will be 1,500 hours and the coating will be of the same character as now used on the 10-watt sign lamp. This lamp will not be available in large quantities until about Nov. 1. To fit these lamps the merchandising department of the company at Bridgeport is developing a line of intermediate screw socket and receptacles.

Hook-Operated "Disconnect"

The 37-kv., 400-amp. type "DI-3" hook-operated disconnecting switch, as shown in the illustration, has been placed on the market by the Railway & Industrial Engineering Company of Greensburg, Pa. To operate this switch a large ring is provided on the combination latch and pry-out arrangement so that a pull from any direction will open the blade. Besides the style shown, it can be made up as a double-throw or a selector switch and is suitable for mounting in any position. The standard features claimed by the manufacturer for this "disconnect" are the interchangeability of parts, self-aligning full-floating contacts and truss blades.



UNDERGROUND TYPE HOOK-OPERATED DISCONNECT SWITCH

Mine-Hoist Control

A line of magnetic control for mine-hoist service has been developed by the Westinghouse Electric & Manufacturing Company. All contactor panels are furnished 76 in. high. The high-voltage air-break reversing contactors are provided with current interlocks to prevent one contactor from closing until the arc has been completely extinguished on the contactor being opened. Both high-voltage and low-voltage reversing contactors are mechanically interlocked. The high-voltage reversing contactors are of the two-pole design. The connection of the two-pole contactors provides opening of all power leads to the motor stator and insures against overwinding the hoist as the opening of any two-pole contactor opens two phases of the line. The arc-rupturing ability of these high-voltage contactors is said to provide reliable operation even under adverse conditions. The contactors are of the floating armature construction and are self-aligning.

The company has also developed an alternating-current magnet valve for operation of electro-pneumatic unit switches. Heretofore only direct-current magnet valves have been available. This development thus permits the use of alternating-current control circuits, and by eliminating the small motor-generator formerly required the cost of the complete electro-pneumatic control for mine hoists is materially reduced.

Contact Conductor

A contact conductor in which double conductors are inserted in a particular manner and held at a sufficient distance from each other to insure proper insulation when the conductor is at rest, but which when compressed, bent, folded, expanded, cut or burned establishes a contact, has been developed by Oscar Nagy, Paris, France. The cable is already being manufactured by several European electrical manufacturers, including the German Telephone Works & Cable Industry of Berlin. The conductor is protected against all outside influences, and it is said that no formation of free sparks is possible.

In tests made by independent concerns it was found that with more than a million contacts made on the same spot the cable was not deteriorated to any perceptible extent. The cable has been in operation for longer than a year at a voltage of 220 without a single fault, and it has also been used for permanent operation at 110 volts with a constant current of 3 amp. The safety limit of the standard type is approximately 1,000 volts.

The necessary devices for applying and erecting the contact conductor—for example, elbows, T-pieces, boxes and so forth—which serve for connecting, branching, closing, securing and guiding purposes, are also made elastic and are therefore capable of producing contact as in the case of the wire itself so that no dead points are possible in an installation using the contact conductor. The manufacture of the Nagy contact conductor does not require any special machinery or elaborate equipment, and any well-equipped cable manufacturer may make the cable without difficulty.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 4, 1927)

1,644,308. CABLE CONNECTER; L. H. Church, Elizabeth, N. J. App. filed April 23, 1926. For outlet boxes.

1,644,309. CABLE CONNECTER; G. C. Thomas, Jr., Elizabeth, and L. H. Church, Roselle, N. J. App. filed July 8, 1926. For outlet boxes.

1,644,310. CABLE CONNECTER; H. L. Strongson, New York, N. Y. App. filed Dec. 4, 1922. For outlet boxes.

1,644,311. CABLE CONNECTER; A. P. Davis, Baltimore, Md. App. filed Nov. 29, 1926. For outlet boxes.

1,644,312, 1,644,313. CABLE CONNECTER; G. C. Thomas, Jr., Elizabeth, N. J. Apps. filed Feb. 25, 1927. For outlet boxes.

1,644,332. FREQUENCY TRANSFORMER; T. J. Fay, Brooklyn, N. Y. App. filed June 13, 1924. For ignition systems and radio.

1,644,344. PRIMARY CELL; M. L. Martus, Woodbury, Conn., and E. H. Becker, Waterbury, Conn. App. filed Dec. 29, 1926. Of the Lalande type.

1,644,370. METHOD OF ARTIFICIALLY PRODUCING RADIOACTIVE SUBSTANCES; A. Gaschler, Berlin, Germany. App. filed Sept. 4, 1924.

1,644,389. PRIMARY CELL AND METHOD OF MAKING THE SAME; M. L. Martus, Woodbury, Conn., and E. H. Beckler, Waterbury, Conn. App. filed Jan. 3, 1927. Of the Lalande type.

1,644,421, 1,644,422. APPARATUS FOR INDICATING VOLTAGE STRESS; F. C. Doble, Cambridge, Mass. Apps. filed June 10, 1922, and April 8, 1925. For testing the insulating qualities of electrical insulation under conditions of high-voltage stress.

1,644,430. TIME-LIMIT RELAY; H. H. Herbers, East Orange, N. J. App. filed Nov. 13, 1924. For electric motors used in driving large printing presses, whereby the motor may be caused to apply its maximum driving torque for a short period only when the driven mechanism is being started.

1,644,443. THERMALLY OPERATED CIRCUIT BREAKER; P. B. Parks, Oak Park, Ill. App. filed Feb. 19, 1925.

1,644,452. LAMP FIXTURE; W. H. Spencer, Bogota, N. J. App. filed March 4, 1926.

1,644,467. REGULATOR SYSTEM; C. Le G. Fortesque, Pittsburgh, Pa. App. filed Sept. 1, 1921. For maintaining the exciting flux of a dynamoelectric machine substantially constant.

1,644,479. SWITCHING SOCKET; W. Leschman, Chicago, Ill. App. filed Nov. 12, 1925. In which the circuit is switched on and off by rotational movements of a handle projecting from the rear end of the socket.

1,644,525, 1,644,526, 1,644,527. CIRCUIT-PROTECTING SYSTEM; W. E. Hoyler, Buffalo, N. Y. Apps. filed Oct. 17, 1925. Will shut off the current when the line is overloaded or short-circuited, then will turn the current back on when the overload or short-circuit is removed.

1,644,590. STORAGE BATTERY; W. E. Holland and W. H. Grimditch, Philadelphia, Pa. App. filed March 5, 1923. Having dry charged plates and separators so assembled that the battery may be put into use without charging, very soon after filling with suitable electrolyte.

1,644,593. THREE-WAY SOCKET; W. Ile, Jackson, Mich. App. filed June 11, 1925.

1,644,604. TRANSFORMER FOR ELECTRIC ARC CUTTING AND WELDING APPARATUS; F. C. Owen, Fayetteville, N. C. App. filed Nov. 19, 1925.

1,644,626. ELECTRIC FUSE; R. H. Barklie, Purley, England. App. filed Jan. 19, 1927. Capable of being operated by very small currents such as those of 30 milliamp. and less.

(Issued Oct. 11, 1927)

1,644,703. MATERIAL FOR COMMUTATOR BRUSHES; F. C. Atkinson, Indianapolis, Ind. App. filed April 25, 1923. Consisting essentially of carbon intimately mixed with metallic copper or other metals or alloys of proper conductivity in the form of firm blocks, rods or sticks.

1,644,712. ELECTRIC LAMP; A. De Graaff, Eindhoven, Netherlands. App. filed April 17, 1923. Oxygen getter to prevent excessive sagging.

1,644,718. ARMATURE; P. J. Fitzgerald, Torrington, Conn. App. filed July 16, 1925. Method of winding and insulating.

1,644,729. STATIONARY INDUCTION APPARATUS; S. E. Johannesen, Pittsfield, Mass. App. filed Feb. 21, 1922. Of the distributed-core type.

1,644,746. DRY-CELL ELECTRODE AND METHOD OF MAKING THE SAME; K. H. W. Ramsay, Summit, N. J. App. filed Dec. 26, 1925.

1,644,767. ELECTRICAL PLUG; H. J. Zimmermann, Cleveland, Ohio. App. filed May 22, 1922. Adapted to connect conducting wires to an electrical socket by merely pushing the plug into the socket.

1,644,812. GRINDING MACHINE; J. L. Ballash, Cleveland, Ohio. App. filed March 28, 1925.

1,644,820. MOTOR CONTROLLER; W. Driver, Racine, Wis. App. filed April 26, 1926. Adopted for controlling sewing machines.

1,644,843. ELECTRIC SHOT-FIRING DEVICE; A. J. Marshall, Harrisburg, Ill. App. filed March 8, 1926. For firing shots in mines.

1,644,853. STORAGE-BATTERY SEPARATOR; P. E. Norris, Wilkinsburg, Pa. App. filed Jan. 12, 1922.

1,644,875. OVER-TEMPERATURE CONTROL FOR ELECTRIC SADIRONS; O. Dodge, Colorado Springs, Col.

1,644,911. ELECTRIC PRESS; A. R. Braun, Syracuse, N. Y. App. filed March 25, 1924. Ironing press.

1,644,935. COMBINES PRESSURE AND FLOAT-ACTUATED SWITCH; I. E. McCabe, Chicago, Ill. App. filed Aug. 11, 1925.

1,644,969. MULTIPLE-FUSE PLUG; F. W. Williams, Santa Maria, Cal. App. filed Jan. 9, 1926.

1,644,990. ELECTRIC SWITCH SOCKET; C. S. Cross, Brooklyn, and C. A. Smith, Flushing, N. Y. App. filed Dec. 15, 1925. Means for limiting the inward threading movement of the terminal of a lamp or other appliance and thus obviating the possibility of injury to the switch mechanism.

1,645,019. ELECTRIC SWITCH; E. L. Opperman, Rochester, N. Y. App. filed June 26, 1925. Adapted to cut off automatically the current of an electric machine when the latter becomes overloaded.

1,645,020. OVERLOAD RELAY; J. H. Pengilly, Los Angeles, Cal. App. filed Dec. 29, 1926. For an induction motor.

1,645,029. ELECTRIC HEATING APPARATUS; J. P. Sunderland, Port Chester, N. Y. App. filed Nov. 22, 1926. Wherein the device to be heated forms the secondary of a transformer.

1,645,033. BATTERY CONNECTER; J. J. Witkowski, Albion, N. Y. App. filed Aug. 27, 1926.

1,645,049. ARC-WELDING SYSTEM; A. K. Harford, Oakland, Cal. App. filed June 3, 1926. In which a metallic electrode is employed for establishing an arc directly upon the work to be welded.

1,645,055. ELECTRIC SWITCH; H. J. H. Huber, Schenectady, N. Y. App. filed Nov. 22, 1922. Switch contact member as used in oil switches.

1,645,057. THERMIONIC CURRENT TRANSFORMER; L. H. Junken, Schenectady, N. Y. App. filed Dec. 29, 1925.

1,645,064. VENTILATION OF DYNAMO-ELECTRIC MACHINES; G. Lewinnek, Berlin, Germany. App. filed Oct. 26, 1925. Of the inclosed type.

1,645,070. DYNAMO-ELECTRIC MACHINE; R. Pohl, Berlin, Germany. App. filed Aug. 3, 1925. With shielding of the magnetic structural elements in which it is undesirable to allow the penetration of a changing flux.

1,645,074. ELECTRIC FURNACE; J. A. Seede, Schenectady, N. Y. App. filed June 5, 1926. Induction metal-melting furnaces.

1,645,077. MOISTURE METER; L. W. Thompson, Schenectady, N. Y. App. filed April 1, 1925. To measure the moisture in paper as it comes from the drier rolls.

1,645,085. ELECTROLYTIC RECTIFIER; Le P. P. Bensing, Cleveland, Ohio. App. filed Aug. 31, 1925.

1,645,090. BUSHING-TERMINAL CONNECTER; C. F. Burgeson, Minneapolis, Minn. App. filed Oct. 2, 1926.

1,645,091. ELECTRIC FURNACE; V. J. Chapman, Schenectady, N. Y. App. filed March 26, 1925. Provided with one or more electrodes for generating heat.

1,645,119. ELECTRIC FURNACE; C. Steenstrup, Schenectady, N. Y. App. filed Dec. 1, 1922. In which the operations are carried out in the presence of a selected gas in a closed container which is heated by internal resistors.

1,645,126. PROCESS OF PREPARING LOW-CARBON ALLOYS; V. B. Browne, Tarentum, Pa. App. filed Jan. 9, 1923.

1,645,130. PUSH-SWITCH SOCKET; E. H. Freeman, Trenton, N. J. App. filed June 9, 1923.

1,645,145. SWITCH; L. Kellner, Chicago, Ill. App. filed July 8, 1925. Quick-make-and-break type adapted to be used in lighting circuits.

New Trade Literature

THEATRICAL LIGHTING.—The Display Stage Lighting Company, Inc., 334 West Forty-fourth Street, New York City, is distributing catalog B, covering complete electric lighting equipment for theatrical productions, pageants, expositions, architectural and show window lighting, theatrical lighting effects and spectacular and electro-mechanical effects.

LABORATORY EQUIPMENT AND RESISTORS.—"Electrical Laboratory Apparatus and Educational Service" is the title of bulletin GEA-450A issued by the General Electric Company, Schenectady, N. Y. The bulletin describes and illustrates alternating- and direct-current motors and generators, synchronous converters, sine-wave testing sets, magnetic controllers, grids and loading devices, circuit breakers, dynamometers, capacitors, transformers, meters, etc., for laboratory use. The company is also distributing bulletin GEA-152A, covering its type "AW" auxiliary welding resistors.

UNIT HEATERS.—The American Blower Company, Detroit, has issued a catalog covering its various types of "Venturafin" unit heaters for heating garages, factories, offices, etc.

ELECTRICITY.—The General Electric Company, Schenectady, N. Y., has issued a catalog entitled "Electricity the Pathway of Prosperity." This catalog gives details on general farm electrification, the electrical dairy farm, how to make poultry pay with electricity, making farm life better, economics of farm electrification, the right size of a motor to use and the cost of operation of electrical apparatus.

LIMITATOR.—Bulletin No. 11 issued by Edward T. Moore, Syracuse, N. Y., describes and illustrates the "Edmoore" power-demand limiter. It gives an idea of the operation and application of the limiter.

AUTOMATIC SUPERVISORY EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-796, covering its cable-type automatic supervisory equipment for control and indication of remote power apparatus.

STOKERS. — "The Most Economical Method of Burning Coal" is the title of a bulletin No. 979 issued by the Detroit Stoker Company, Detroit, in which it describes and illustrates the various types of "Detroit" stokers. The bulletin outlines the factors to be considered in selecting fuel-burning equipment.

PUSH-BUTTON STATIONS. — Bulletin GEA-118A issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the CR2940 push-button stations for use in the control circuits of all types of magnetic controllers.

OIL CIRCUIT BREAKERS AND STANDARD-UNIT RELAYS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-704A, covering its oil circuit breakers, types "FK-132-A," "FK-132-B," "FKR-132-A" and "FKR-132-B." The company is also distributing bulletin GEA-810, describing its standard-unit relays, type "PQ-106."

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Knowle, England (No. 27,776), for storage batteries, portable electric tools and spark plugs and ignition apparatus.

Purchase and agency are desired in Milan, Italy (No. 27,839), for storage batteries.

An agency is desired in Sydney, Australia (No. 27,766), for electric ironing machines, ranges, fireless cookers and vacuum cleaners.

An agency is desired in Paris, France (No. 27,761), for electrical specialties and mechanical novelties.

An agency is desired in Sao Paulo, Brazil (No. 27,771), for electric motors and insulated wire.